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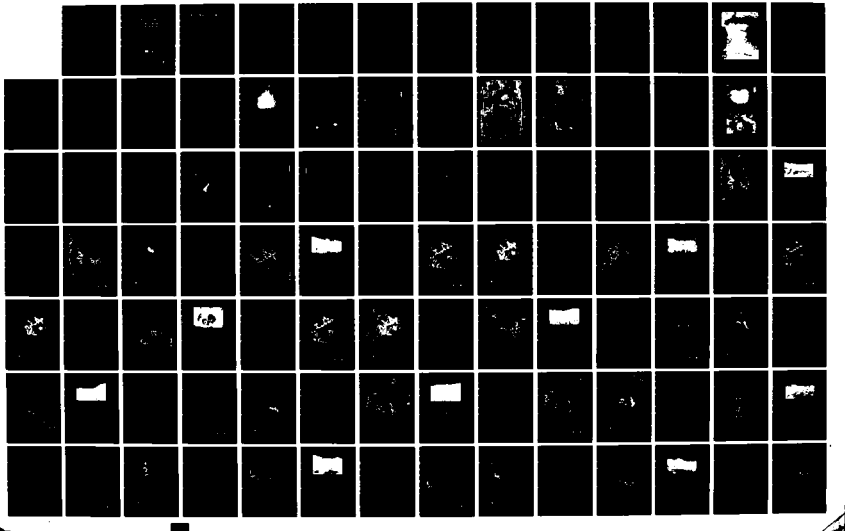

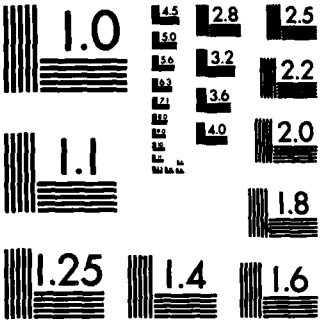

NWC TP 6403

Distribution and Status of *Sclerocactus Polyancistrus* on the Naval Weapons Center—A Survey

by
Richard W. May
for the
Public Works Department

OCTOBER 1982

NAVAL WEAPONS CENTER
CHINA LAKE, CALIFORNIA 93555

Naval Weapons Center

AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

FOREWORD

The survey documented in this report was conducted during 1982 to determine the status of the endangered Mojave Fishhook Cactus (*Sclerocactus polyancistrus*) on the Naval Weapons Center, China Lake, Calif. The work was performed under Contract No. N62474-81-C-A355, and was funded by appropriations established by Congress in 1978 in response to Public Law 86-797 (the Sikes Act), which authorizes the Secretary of Defense to carry out fish and wildlife conservation programs on military installations.

This report was reviewed for technical accuracy by T. J. McGill and B. J. Kohfield.

Approved by
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Capt., CEC, U.S. Navy
Public Works Officer
30 October 1982

Under authority of
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Endangered species	*Sclerocactus polyancistrus*	Infestation	Botanical
Phenology	Mojave Fishhook Cactus	Flora	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

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(U) *Distribution and Status of* Sclerocactus Polyancistrus *on the Naval Weapons Center*, by Richard W. May. China Lake, Calif., NWC, October 1982. 130 pp. (NWC TP 6403, publication UNCLASSIFIED.)

(U) *Sclerocactus polyancistrus*, a highly vulnerable plant with a history of having been extensively collected, is listed in recent publications as a threatened species. Military reservations and other areas that restrict public access may represent a final refuge for the plant.

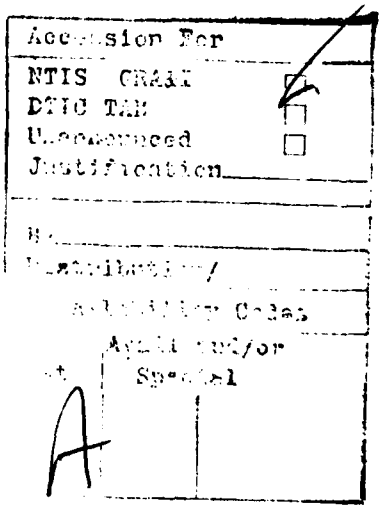
(U) This report presents the results of a survey performed to determine the status of *Sclerocactus polyancistrus* on the Naval Weapons Center, China Lake, Calif. In addition to enabling the Navy to comply with Section 7 of the Endangered Species Act of 1973, which requires federal agencies to protect threatened or endangered species as determined by the Secretary of the Interior, the survey provides a convenient reference source for the Navy in support of current and future environmental studies and land management programs.

PREFACE

Sclerocactus polyancistrus, an attractive member of the Cactaceae family, has been reported to be decreasing in distribution and density over a significant portion of its range. This plant is highly vulnerable and has a history of having been extensively collected. It has been recommended in recent publications as a threatened species, such as in the book by Ayensu and DeFilipps (1978) and in two reports by Rhoads, Cochrane and Williams (1978, 1979) prepared for the U.S. Department of Energy. In addition, the California Native Plant Society has listed it as endangered in part, confined to several declining populations (REVD Code 2222). More recently, it has appeared in the Federal Register (Dec. 1980) as recommended for threatened status.

Since over-collection is a significant threat to this species, military reservations and other areas restricting public access may represent a final refuge for this plant. Section 7 of the Endangered Species Act of 1973 requires federal agencies to protect threatened or endangered species as determined by the Secretary of Interior and to refrain from actions which would endanger such species. The intent of this survey was to determine the distribution and habitat of Sclerocactus polyancistrus on the China Lake Naval Weapons Center and, in doing so, enable the Navy to comply with section 7 of the Endangered Species Act.

Richard W. May



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ACKNOWLEDGMENT

The author would like to thank the following people who assisted in the collection or assimilation of data contained in this report: Mary DeDecker, botanist, for her assistance in the identification of flora; Dr. John T. Doyen, entomologist at U.C. Berkeley, who provided valuable information relative to the identification and habits of insects collected; Dr. Carl Gray, soil chemist at Texas A&M University, for his assistance in obtaining the soil analyses; and Mary Ann Henry, who provided known distribution data on the Naval Weapons Center.

The author would also like to thank all of the Environmental Branch personnel at the Naval Weapons Center for their help, particularly Dr. Tom McGill for coordinating travel and security and Bev Kohfield and Denise Laberteaux for their help in the field.

FIGURE 1-1 S. polyancistrus (Mojave Fishhook Cactus) in bloom.

1.0 INTRODUCTION

This survey was performed to determine the status of Sclerocactus polyancistrus (hereafter abbreviated "Scpo") (Figure 1-1) on the China Lake Naval Weapons Center (NWC). In essence, it serves a dual purpose. First, it provides a convenient reference source for the Navy in support of current and future environmental studies and land management programs. Second, it expands the current ecological data base of the species. The organization of the material presented herein is directed toward this end.

Section 4.0 presents taxonomic data and generalized NWC distribution maps for this species. It is intended to serve as a convenient reference guide for field identification.

Section 5.0 briefly describes the ecology of the species, enabling one to correlate the findings from this survey on the NWC with past data collected elsewhere.

Section 6.0 is included to familiarize the reader with the physiography and geology of the NWC region as it relates to this species.

Section 7.0 contains the bulk of the field data collected, including descriptions of each population and detailed maps depicting densities and habitat locations.

It was not the intent of this survey to provide a comprehensive botanical or ecological survey of the study area. Only of late, however, have attempts been made to collect such data in this region, the most notable by Zembal (1979) and DeDecker (1980). Therefore, additional botanical information was recorded, when possible, particularly in the remote areas to support current and future NWC field studies. To this end, partial lists of flora were compiled and are contained in Section 8.4.

Also in Section 8.0, several discussion topics appear and represent a summary of the more significant findings or conclusions as a result of this survey.

It is hoped that the data collected will assist the Navy in carrying out future land management programs on the NWC as well as provide a better understanding of this species and the habitat in which it is found.

1.1 How To Use This Report

- To locate where *S. polyancistrus* exists on the NWC ranges:

  1. Review Section 4.0 distribution maps.
  2. Check Population Cross Reference Index (Table 4-2) in Section 4.0. If more detailed information is required on any one population, turn to appropriate Section 7.0 page as cited in Table 4-2.

- To conduct *S. polyancistrus* field study on NWC:

  1. Review Section 4.0 for taxonomic information and known distribution data.
  2. Review Sections 5.0 and 8.0 for ecological information on the species.
  3. If study is to be performed in an area where Scpo has been confirmed, review applicable population data found in Section 7.0 (refer to Table 4-2).

- To obtain general information on the species:

  1. Review Sections: 4.0, 5.0, 6.0, 7.0, and 8.0.

2.0 OBJECTIVES

The primary objective of this survey was to provide field data on Sclerocactus polyancistrus in selected study areas on the China Lake Test Range Complex, Mojave B/Randsburg Wash Test Ranges, and pertinent peripheral areas with special emphasis on the identification, population density, and location of habitat of this species.

In addition, since little fieldwork in general had been done previously in many of the areas surveyed and in order to maximize the data return in support of ecological research relative to this species, an attempt was also made when possible to obtain:

- additional demographic information to include age classifications and evidence of reproduction (seedlings)
- physiographic and topographic characteristics of the habitat
- identification of threats (natural or man-made)
- photography
- soil and rock samples
- a partial list of flora in each habitat

3.0 METHODOLOGY

Distribution and local population density maps have been compiled for each area surveyed. Because so few plants of this species typically exist within any one area, transects are not practical. Population densities were estimated based on the number of sitings during the passage through a given area and then extrapolated for immediately adjacent areas. Results from more comprehensive population density studies conducted elsewhere were also utilized in the extrapolation process in order to arrive at more realistic density values. To ground truth, a plot of land (usually 1 hectare) was selected at random in some locations and a more thorough search conducted.

It should be noted that surveys conducted during the blooming period tend to yield higher densities since the plants are easier to spot. In contrast, smaller stems (and seedlings) which are not in bloom are less conspicuous and are often missed. Therefore, the percentage of smaller stems recorded (tabulated in Section 7.0) during population inventories tends to be lower than actual. Based on the author's past findings, densities of one per hectare should be considered an average for populations of this species.

Total stems present within an area have also been estimated and appear on the Summary Data Sheets found in Section 7.0. These estimates relate to the regions surveyed only and do not include peripheral areas. Peripheral areas are depicted on the potential range maps which also appear in Section 7.0.

The size of the stems recorded has been used as a rough estimate of age determination since, to date, data collected by the author correlating growth rates and actual age are inconclusive.

Additional comments relative to methods employed are found in their respective section within the text of this report.

4.0 NWC FIELD GUIDE TO THE SPECIES

The following field guide has been compiled to assist NWC personnel during future field studies relative to Sclerocactus polyancistrus.

TAXON NAME: Sclerocactus polyancistrus (Engelmann & Bigelow) Britton and Rose. Britton, N.L. & J.N. Rose. 1922. Cactaceae 3: 213-215.

SYNONYMS: Echinocactus polyancistrus (Engelmann & Bigelow) Engelmann, G. 1856. Proc. Amer. Acad. 3: 272

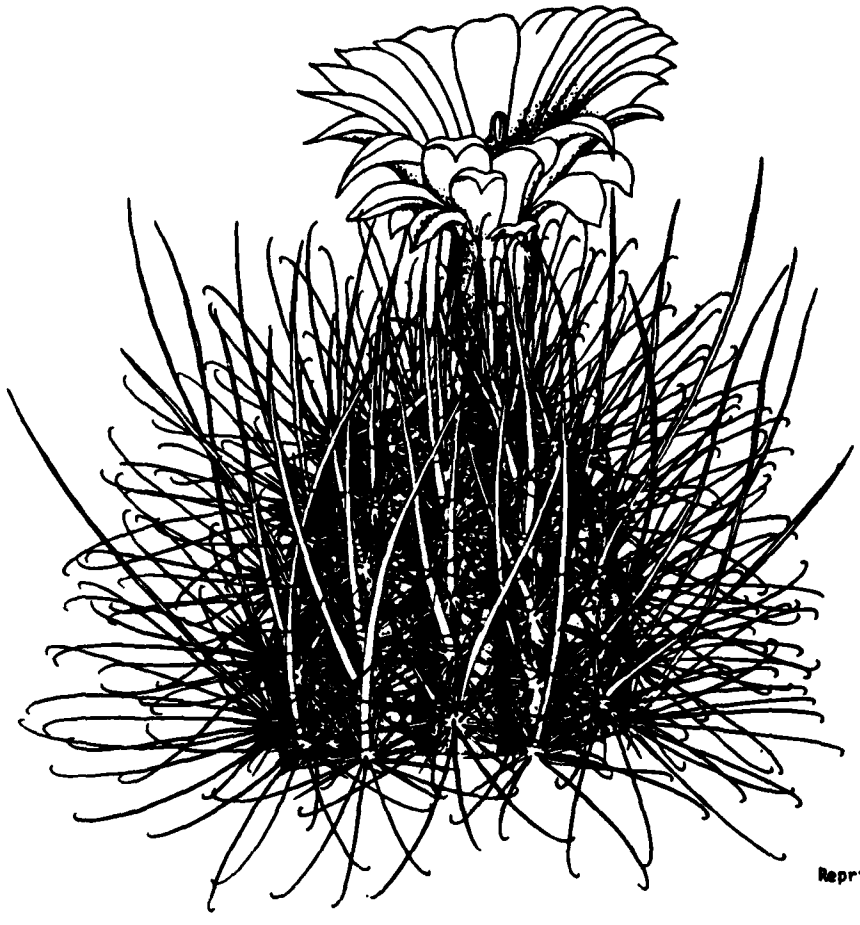
COMMON NAMES: Mojave Fishhook Cactus
Hermit Cactus
Pineapple Cactus
Devil's Claw
Mojave Bisnaga

FAMILY: Cactaceae (Cactus)

DESCRIPTION:

(Non-technical)

Barrel type cactus, usually 3-8" tall, but occasionally reaching 12-16" in height & 4-6" in diameter; stems have been found (rare) 25" in length & 8" in diameter (partially prostrate); Spines 6-8 dark red (most hooked) & 3 white, usually 2-4" long; 10-15 shorter white radial spines at each areole (rare form exists with pale yellow spines instead of dark red spines); stems ribbed and do not branch unless damaged; usually solitary; flowers magenta-pink, emerge from top of plant; flowering times vary, usually mid-May to early June on the NWC; fruit naked, green initially, red when ripe; seed black, hard, 3/32" at widest point.



Reprinted from: California Cactus
by E.M. Baxter (1935)

Technical Description

Sources: Benson, L. 1969. The Native Cacti of California
(Engelmann & Bigelow) Britton & Rose
(modified per author's own findings)

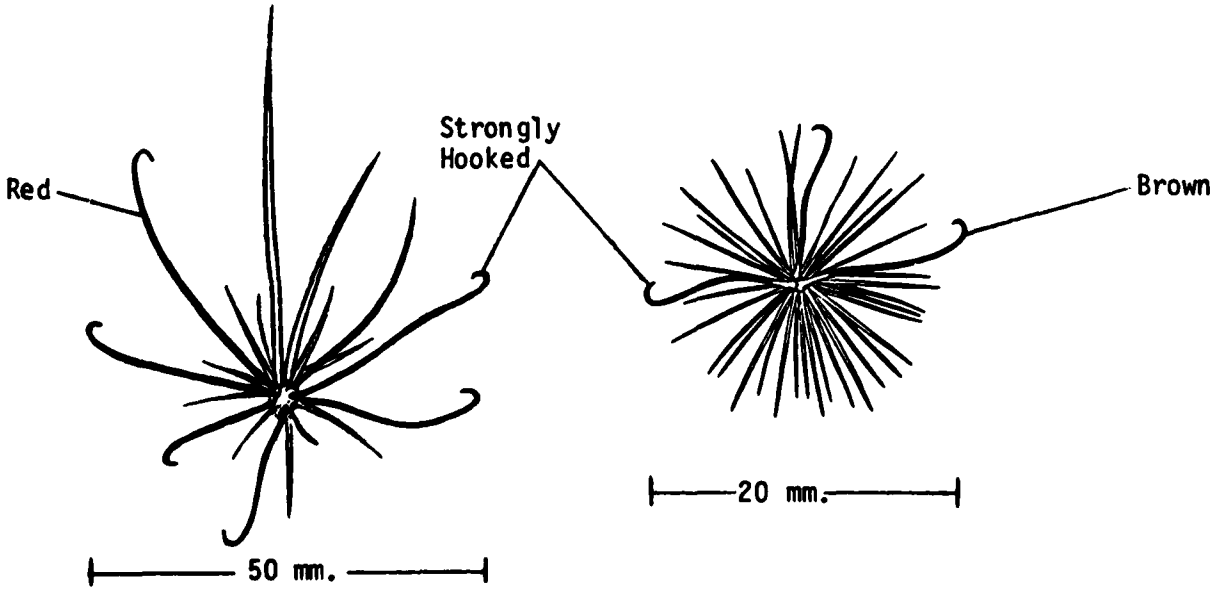
Stem usually solitary, green, cylindroidal, usually 8-20 cm. long, 5-10 cm. in diameter, occasionally reaching 40 cm. long and (rare) 60 cm. long, 15-20 cm. in diameter; ribs clearly developed, usually 13, the tubercles strongly coalescent basally, about 12 mm. long vertically, 9 mm. broad, protruding 6 mm. high; areoles elliptic, about 6-7.5 mm. long, typically about 9 mm. apart; spines dense, almost obscuring the stem, particularly when desiccated; central spines 9-11, the usually 6-8 lower and lateral central spines dark red (maroon), the longer ones up to the length of the median upper central, basally up to 0.7 mm. in diameter, acicular, nearly circular in cross section, all but 1 or 2 hooked; the 3 upper central spines white, flat, conspicuous, erect 7.5-10 cm. long (occasionally up to 15 cm. long), the lateral about 1/3 to 2/3 as long, up to about 3 mm. broad or occasionally wider; radial spines white, 10-15 per areole, spreading in a circle, white, straight, the longer ones usually 2 cm. long, .5 mm. broad basally, somewhat flattened, elliptic in cross section; flower about 5 cm. in diameter, 5-6.0 cm. long; sepaloid perianth parts with the midribs greenish-purple and the margins rose-purple or magenta, the largest ones cuneatespathulate, about 2.5 cm. long, 6-9 mm. broad, angled, entire or finely toothed; petaloid perianth parts magenta (occasionally pink when faded; occasionally white below the tips), the largest one broadly ovate-lanceolate, about 2.5 cm. long, 9-12 mm. broad, apically angled or mucronate, entire or the margins slightly irregular; filaments yellow, about 6-9 mm. long; anthers yellow, 1.5 mm. long, narrowly oblong; style 2.5 cm. long, 1.5 mm. in greatest diameter; stigmas about 10, 3 mm. long, slender; ovary 9 mm. lg., a few scale-leaves; fruit green (red when ripe), brown when dry, 3-4 cm. long. Seed black, finely tuberculate, papillate-reticulate, angled on one side of the hilum, rounded on the other, broader than long, 3-3.5 mm.

NWC Field Identification

This plant is very distinct and can easily be distinguished from other cacti within the NWC Test Ranges. Its primary distinguishing characteristic should be the dark red spines which are flexible, strongly hooked, and usually 5 to 8 cm. long. The growth pattern is usually solitary.

There is only one other cactus in this area with strongly hooked spines: Mammillaria tetrancistra (see below). This cactus is much smaller, usually less than 10 cm. tall and 4 cm. in diameter. Its spines are mostly white (the hooked ones are brown), much shorter, and densely cover the stem to give it an overall white appearance. It too has been commonly called the "Fishhook Cactus" and, therefore, one should exercise caution when such common name sitings are reported.

Table 4-1 shows favorable and unfavorable characteristics of given setting relative to the possible occurrence of Scpo. Table 4-2 is a population cross reference index. Figures 4-1 and 4-2 show the distribution of Scpo on the China Lake Test Complex and the Mojave B South Range, respectively.



Sclerocactus polyancistrus

Mammillaria tetrancistra

(Illustration from Benson, L. The Native Cacti of California)

TABLE 4-1 Favorable and unfavorable characteristics of a given setting relative to the possible occurrence of Scpo. This table is very general and has been compiled to assist in future field studies on the NWC.

SOIL COLOR	ALTITUDE	AVERAGE SLOPE	ASPECT	SOIL POROSITY	pH	GEOLOGICAL SETTING	FAVORABILITY OF SETTING
LIGHT	640-1830 m. (2100-6000')	5-45°	SOUTH & WEST	HIGH	>7.6	GRANITE RHYOLITE	10 VERY HIGH
						SEDIMENTARY *Non-Marine Marine	9 8 HIGH
						METAMORPHIC Gneiss	7
						METAVOLCANIC	6 5 MED
				MEDIUM	7.2-7.6	TERTIARY/QUATERNARY VOLCANIC Basalt/Tuffs	4
	1830-2315 m. (6000-7600')	45-60° 0-5°	NORTH & EAST	MEDIUM - LOW	<7.2	ALL OTHERS	3 LOW 2
DARK RED OR BLACK	<640 m. >2315 m.	>60°		LOW	<7.0	ALL OTHERS	1 VERY LOW

ENTER

*Pleistocene/Pliocene

- Enter table from left side
- While moving from left to right, cross horizontal lines downward only
- Examples:

1) Light colored soil
   3500'
   30° slope
   South aspect
   Porosity Medium
   pH unknown (Skip across)
   Granite (Do not move back up)
   → Favorability Med-Low (3-5)

2) Dark red
   (remaining characteristics not a factor)
   → Favorability Very Low (0-1)

TABLE 4-2 Population Cross Reference Index.

RANGE	NWC AREA	SCPO POPULATIONS PRESENT	RELATIVE DENSITY	SITE DATA PAGE #
China Lake Test Complex	Coso Military Target	Coso Village	Low	30
	Coles Flat	Coso Village	Low	30
		Rd. to Big Petroglyph	High	36
		Louisiana Butte	Low-Med.	48
	Petroglyph Canyons-Wild Horse Mesa	Rd. to Big Petroglyph	High	36
		Mesa	Medium	42
		Louisiana Butte	Low-med.	48
		East Wild Horse Mesa	Low	54
		South Wild Horse Mesa	Low	60
	Junction Ranch	Carricut Lake	Low	66
Mojave B North	Scpo was not found on this range			
Randsburg Wash	Scpo was not found on this range			
Mojave B South	NWC Controlled	Granite Wells	Low	72
		Granite Mtn.	Low-Med	78
		Copper City Spgs.	Low-Med	84
		Indian Spgs.	Low	90
	George AFB Controlled	Copper City Spgs.	Low-Med	84

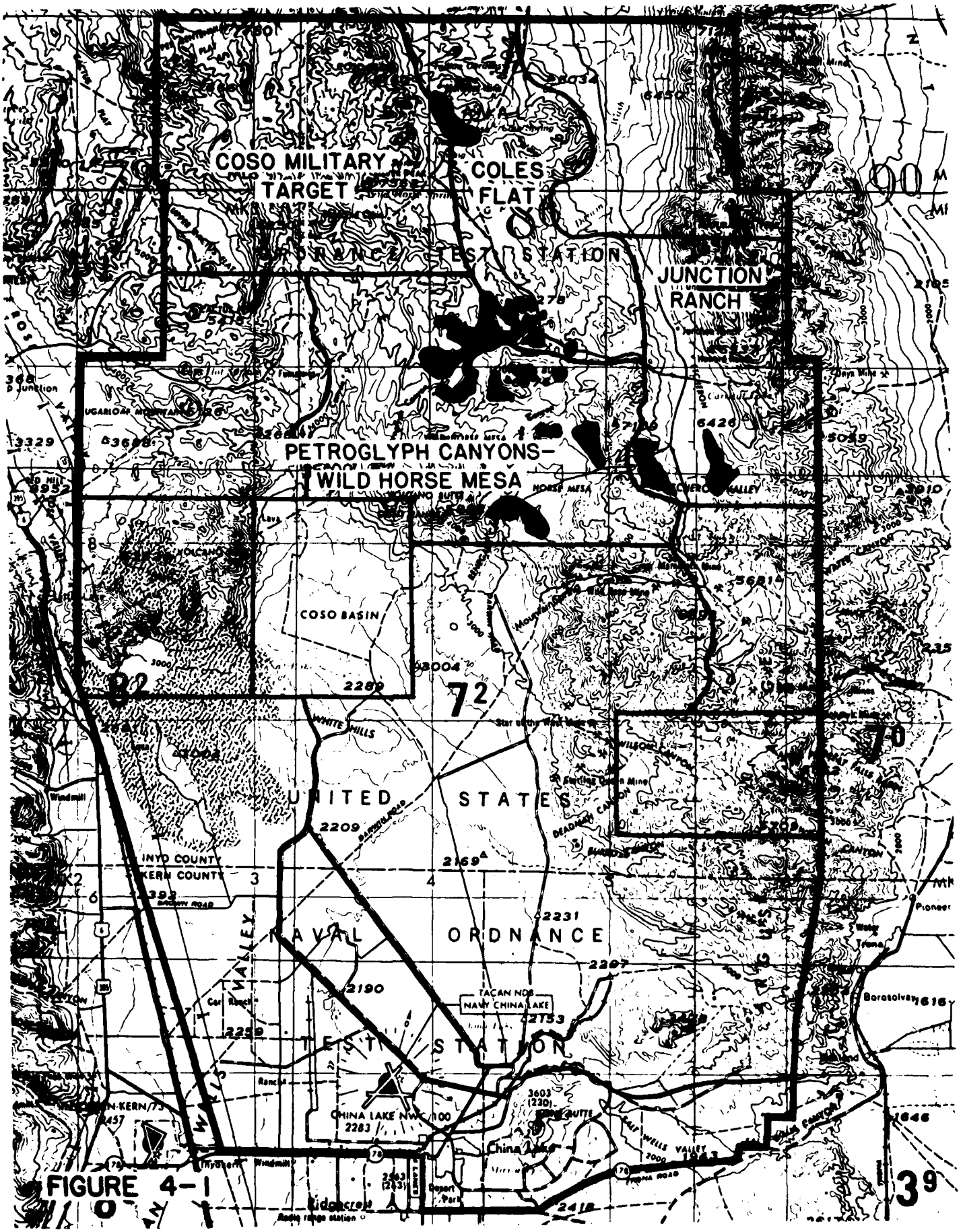


FIGURE 4-1 Distribution of Scpo on the China Lake Test Complex.

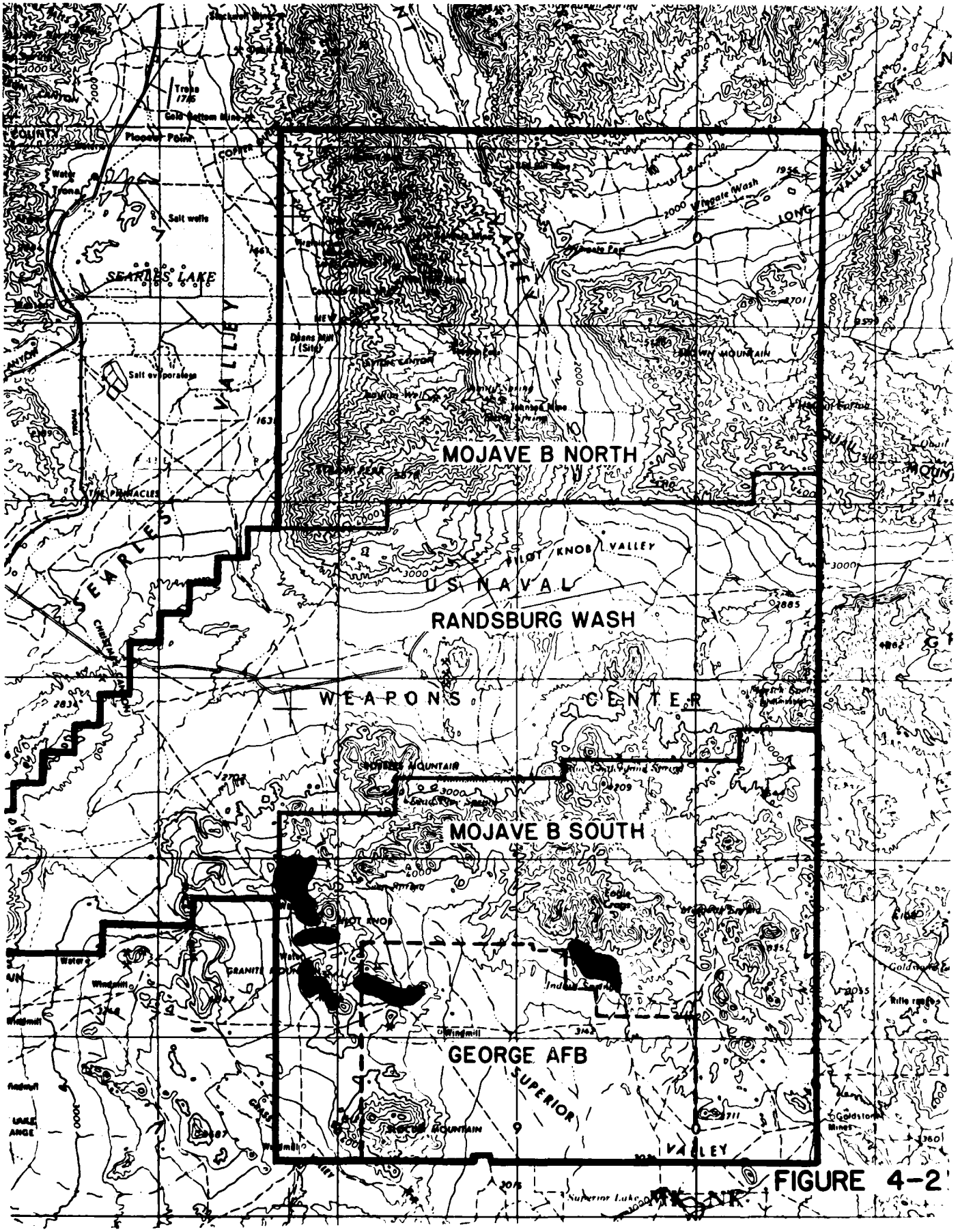


FIGURE 4-2 Distribution of Scpo on the Mojave B South Range.

5.0 INTRODUCTION TO THE SPECIES

The following information is presented to familiarize the reader with the ecology of this species and to enable one to better interpret the data contained in this report.

5.1 Distribution and Occurrence

Sclerocactus polyancistrus is thinly distributed over a large portion of the Mojave and Great Basin Deserts of California and Nevada. Its range lies within the basin and range physiographic province. It is found most frequently in plant communities dominated by Larrea, Atriplex, Artemisia, Grayia, Coleogyne, Haplopappus, Ephedra, and Hymenoclea shrub complexes.

The plant favors porous, alluvial soils most frequently derived from igneous (granite & rhyolite) and sedimentary (Pliocene/Pleistocene non-marine) rocks. It has not been found to date on dark volcanic soils and only occasionally in areas where basaltic rocks are dominant. It is seldom found in flat areas or in areas of poor drainage but, instead, prefers the south and west slopes of hills with slopes less than 45 degrees. Soils are usually alkaline (pH often greater than 8.2) and high in calcium. Elevations range from 730 meters (2400 ft.) to 2300 meters (7600 ft.).

5.2 Phenology and Reproduction

Winter and spring, when the bulk of the precipitation in this region occurs, constitute the growing seasons for this species as well as for most other flora in the Mojave Desert. Since this species is most conspicuous when in bloom, prior knowledge of a population's peak blooming period during a field survey is advantageous. Anthesis varies from population to population depending upon altitude, latitudinal (north-south) location, and other microclimatic factors as well as abnormal fluctuations or extremes in weather. Generally first to bloom are those populations situated in the Mojave River basin and El Paso Mountains in late April and early May. By mid-May the plant is in bloom over most of its range. Larger stems at higher altitude have been found in bloom as late as mid-June. The fruit are normally ripe (red) by early July.

Blooms appear to be chiefly pollinated by non-social and social bees, but more so by the latter. Several pollen-eating beetles are also common visitors, but their ability to effect pollination is still under study. Hummingbirds have also been found to frequent these blooms.

The seeds are relatively large in comparison to other cacti (3-3.50 mm.) and have a hard, black testa. Fresh seeds are difficult to germinate in cultivation and usually must be treated or "aged" before germination can occur with any degree of success. Seeds collected from old carcasses germinate more readily.

5.3 Infestation and Predation

It has been determined through past field studies by the author that the low population densities associated with this species are, in part, due to predation and infestation which manifest themselves by the presence of large numbers of carcasses within populations of this cactus.

There are at least two distinct types of carcasses which appear almost exclusively in two distinct regions of the Mojave (Figures 5-1 & 5-2). Most of the carcasses found in the southern Mojave (generally south of the 36th parallel) are what have been termed "open" carcasses; that is, the spines on the remaining carcass are spread apart. In the northern Mojave, on the other hand, the carcasses are usually intact or "closed", the spine skeleton remaining in the form of the original stem.

Open carcasses have been found to be the result of small mammal predation[1] while the closed carcasses the result of at least one form of infestation.

Microhystological analyses of feces collected inside two open carcasses revealed spine fragments and epidermal tissue from the stem (Foppe, 1981) which suggests that the predator which left these feces also made the initial entry into the stem. Positive identification of predators from feces alone is difficult at best. In this case, they appeared to belong to either the pocket gopher (*T. bottae*) or the ground squirrel (*A. leucurus*) (O'Farrell, 1981). Aside from these findings, the woodrat (*N. lepida*) should also be suspect.

Based on the known distribution of the candidate predators, it would appear that the predominance of open carcasses in the south cannot be attributed solely to the range of any one predator. Greater competition for food is a more

1 This form of predation is not unique to *S. polyancistrus* has been found with *E. Engelmannii*, *E. Johnsonii*, and *E. polycephalus*.

FIGURE 5-1 Typical "closed" carcass of S. polyancistrus. Such carcasses are usually the result of infestation.

FIGURE 5-2 Typical "open" carcass of S. polyancistrus. In most cases, fragments of spines can also be found scattered about the ground in the immediate vicinity of the carcass.

likely explanation. Local densities and the intensity of predation are inversely related and appear to be in a constant state of flux. There may be a fragile balance between this plant and the number of small mammals present at any one location.

Closed carcasses have been found to be primarily the result of infestation due to larvae of the cerambycid beetle Moneilema. Larvae from the moth Distopasta yumaella (Keafott) have also been found within rotting stems and it is possible that other forms of infestation may also occur (see Section 8.1).

It has long been suspected that the carcasses in general play an important role in seedling survival and, consequently, contribute to the proliferation of the species. Seedlings can often be found beneath these carcasses. Seeds trapped in the spines eventually drop down beneath the carcass where conditions appear more favorable for seedling survival due to increased cover and protection from predation.[1]

A significant percentage of mature stems are often found within or adjacent the remains of a carcass as a result of the above process. These old carcasses can, therefore, provide a valuable clue as to the age of the next generation (replacement) plant(s). By noting color fade in the spines of any one carcass year after year, one can acquire a certain degree of expertise in determining the approximate age of these carcasses and, hence, the replacement stem.

It is interesting when one draws an analogy between a population where predation (or infestation) is intense (and, as a result, a large number of carcasses are present) and a population where predation is light. Intense predation appears to produce a greater turnover. More seedlings survive to early maturity within the confines of carcasses but more stems are ultimately eaten. When predation is light, there are fewer carcasses and a greater percentage of seedlings do not survive due to a less favorable medium for growth.[2] Those that do survive, however, have a greater longevity. The carcass, therefore, becomes a mechanism to offset predation.

As a rule, populations where predation (or infestation) is intense have a smaller percentage of larger (older) stems; most of the stems are usually less than 12 cm. tall. These plants are often found in bloom at an early age.[3] In contrast, populations where predation is light tend to support plants with a

1 Spines on small seedlings are extremely frail and afford little protection.

2 Overall densities are usually higher, however, in populations where predation is light. Older stems produce more seed.

3 Possibly due to natural selection. Several populations where predation/infestation is intense have been found containing stems in bloom which were less than 4 cm. tall.

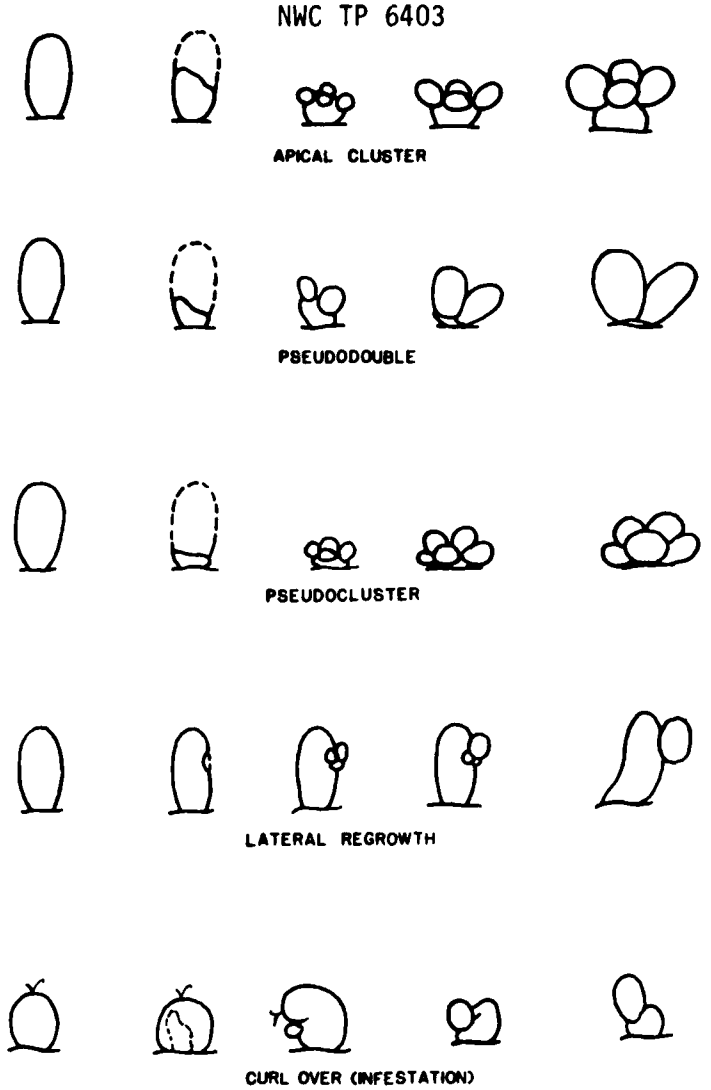


FIGURE 5-3 Morphological abnormalities due to predation and infestation.

greater diversity in age structures resulting in a healthier population.

Another noteworthy observation relative to the above discussion is the higher number of clusters (two or more mature stems adjacent one another) present in areas of intense predation. This again reflects the higher survivability of seedlings under carcasses which occasionally reach maturity as a cluster. There are also a large number of disfigured stems usually with multiple heads or appearing as "pseudo-clusters" as shown in Figure 5-3. This phenomenon also tends to offset predation by increasing the reproductive capability of the plant.

These cacti have probably evolved a balance in nature whereby light to moderate predation is beneficial to the species.

5.4 Threats From Man

Over-collection remains the greatest threat to this species. The popularity of cultivating succulent plants, particularly in the southern California metropolitan areas and by European collectors, continues to exert pressures on this species, especially in the southern Mojave. The genus Sclerocactus, as well as others such as Pediocactus, appear to have a particularly high appeal due chiefly to their rarity, beauty, and unique cultivation requirements which present a challenge to the grower. Unfortunately, many are sold to amateurs or casual collectors who know little about the cultivation of cacti in general, and even less about the requirements of these difficult species. Despite the California Native Plant Act, the author continues to find S. polyancistrus openly sold in desert nurseries within the "Victorville-Mojave-Barstow triangle".

It has also been determined that grazing and associated trampling by sheep and livestock can also impact this species. Unlike the genus Opuntia which can propagate vegetatively, Scpo must rely on successful seed germination and seedling survival for its proliferation. Therefore, the loss of ground cover (grasses) and destruction of shrubs which act as cover reduce soil moisture and increase soil temperatures, erosion, and sun exposure, all of which reduce the chances for seedling survival. Data collected from populations where grazing has occurred have revealed that the destruction of shrubs which act as cover also adversely affects the health and vigor of the surviving mature Sclerocacti. Stems become reddened from sudden and excessive sun exposure and often develop abnormal stem branching due to apical tissue damage. The data has also shown that such stems under stress produce fewer blooms and, consequently, less seed. Soil compaction may also be detrimental since the plant has a surface root system and is edaphic to loose, porous soils.

Off-road vehicle travel, urbanization, highway and utility development, and mining are recognized threats to wildlife and ecology in the Mojave and also have the potential to threaten populations of this cactus.

6.0 NWC REGIONAL DESCRIPTION

Figure 6-1 shows the location of the China Lake NWC ranges in southern California (PBR, 1981).

Figures 6-2 and 6-3 show the major political and cultural features and include the major routes of access.

Figures 6-4 and 6-5 depict the major physiographic features of the region.

The following regional descriptions contain geological data most of which has been taken from U.S.G.S. Survey Maps (Streitz, et al, 1974 and Jennings, et al, 1978).

6.1 General

S. polyancistrus was found on both the China Lake Test Range Complex and the Mojave B South Range, both of which lie within the basin and range physiographic province. Both areas incorporate a large area and, in doing so, also encompass diverse physiographical, geological, and ecological settings. Plant communities are predominantly scrublands and are typical of both the Mojave and portions of the Great Basin Deserts.

Precipitation and temperatures vary considerably depending upon altitude and other microclimatic factors. Precipitation, occurring almost exclusively in winter and spring, averages between 75 mm. (3 in.) at Indian Wells Valley and 225 mm. (9 in.) at higher elevations, but probably between 125 and 200 mm. (5-8 in.) in areas where Scpo was found. Temperature extremes recorded to date range from $-18^{o}C$ ($0^{o}F$) to $46^{o}C$ ($115^{o}F$) at China Lake. Lower temperatures no doubt occur at higher elevations.

6.2 China Lake Test Complex

The eastern boundary of the China Lake Test Complex coincides with the Argus Range, a Massive, north-south chain of mountains which reaches a maximum elevation of 2695 m. (8839 ft.) at Maturango Peak. These mountains are composed chiefly of Mesozoic granites, although some Permian marine sedimentary rocks exist in the northern portion of the range near the NWC boundary. S. polyancistrus was found on the low granitic hills adjacent Etcheron Valley, which is partially embedded in this range.

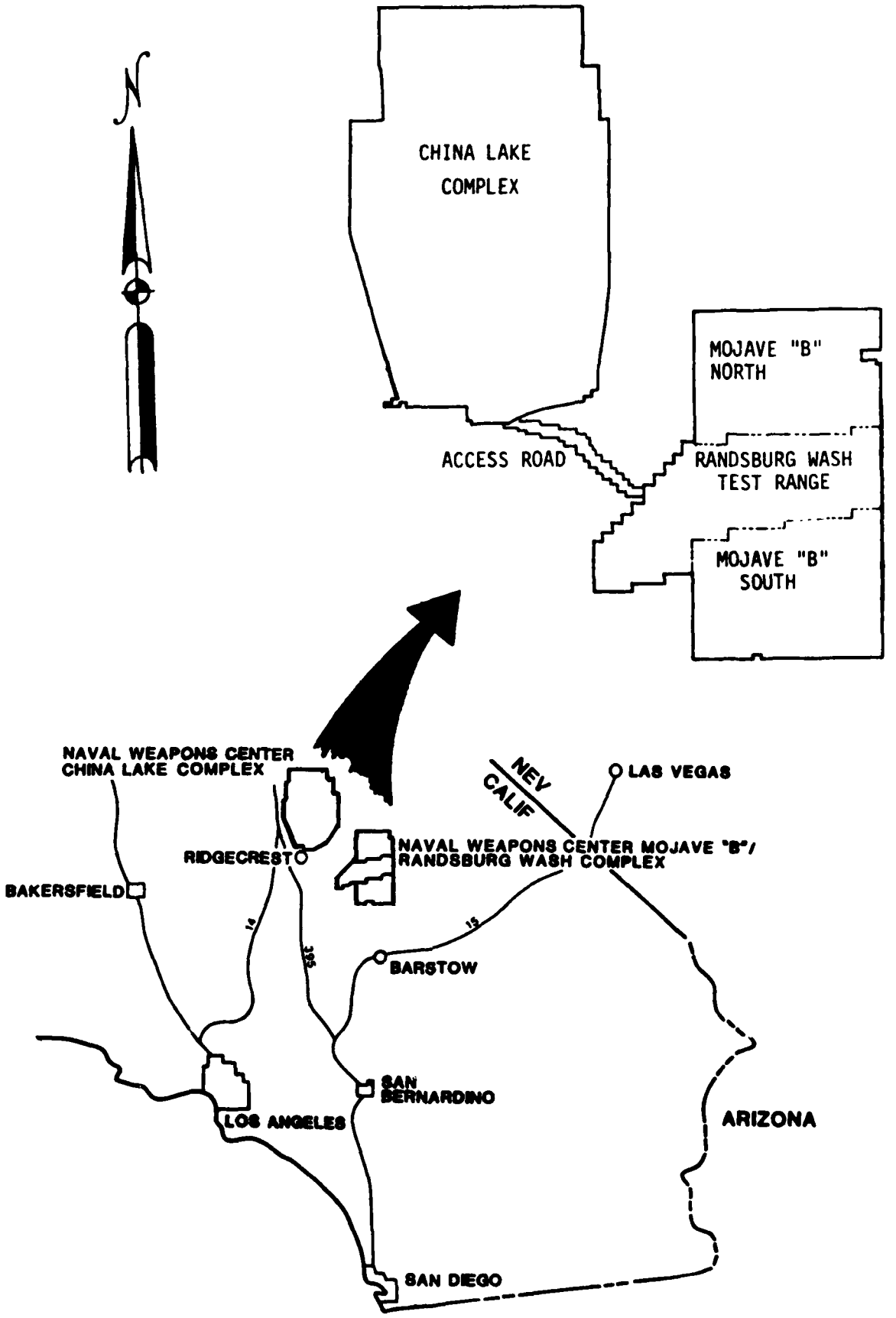


FIGURE 6-1 Location of the China Lake NWC in southern California.

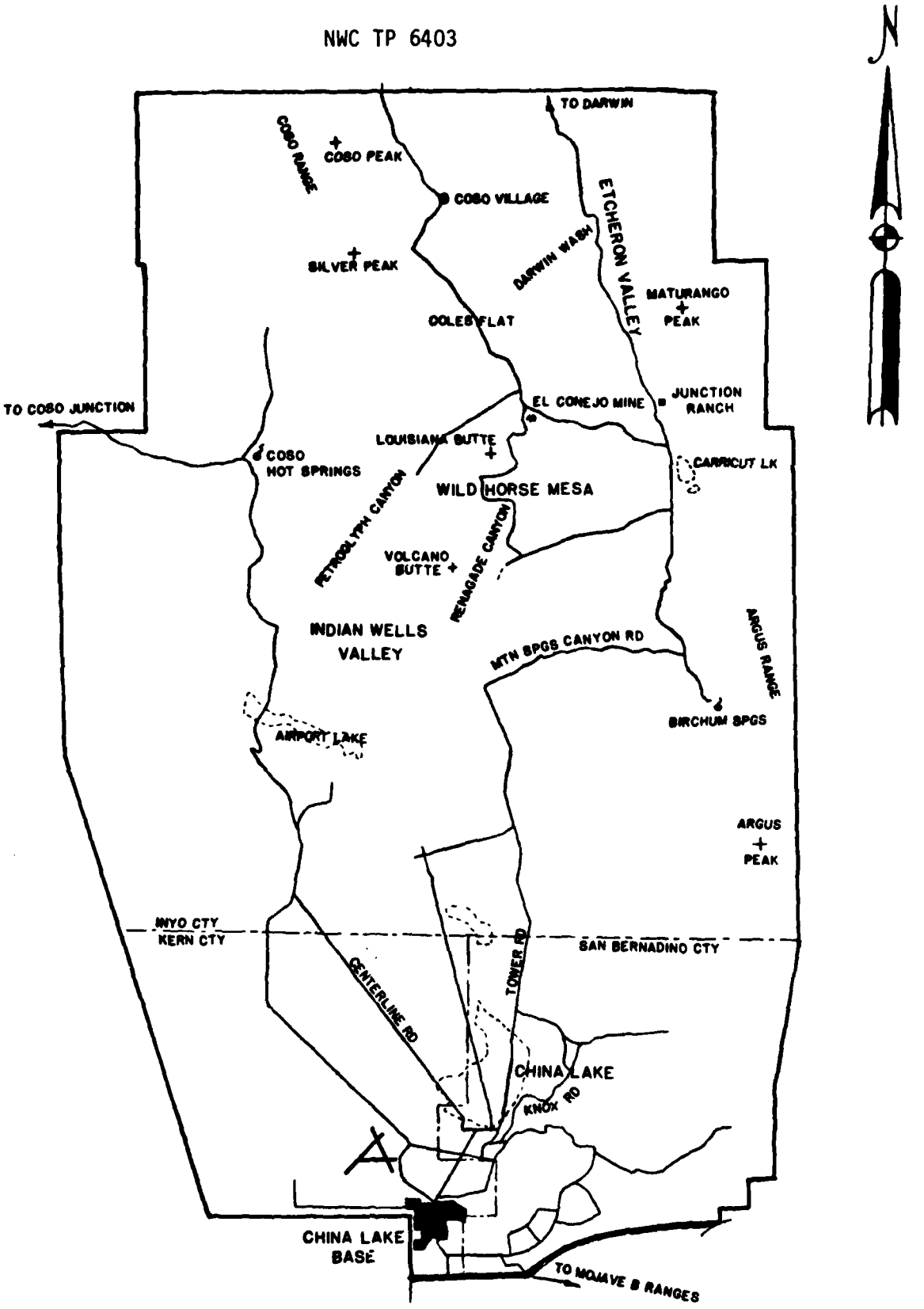


FIGURE 6-2 Major political and cultural features, China Lake Test Complex.

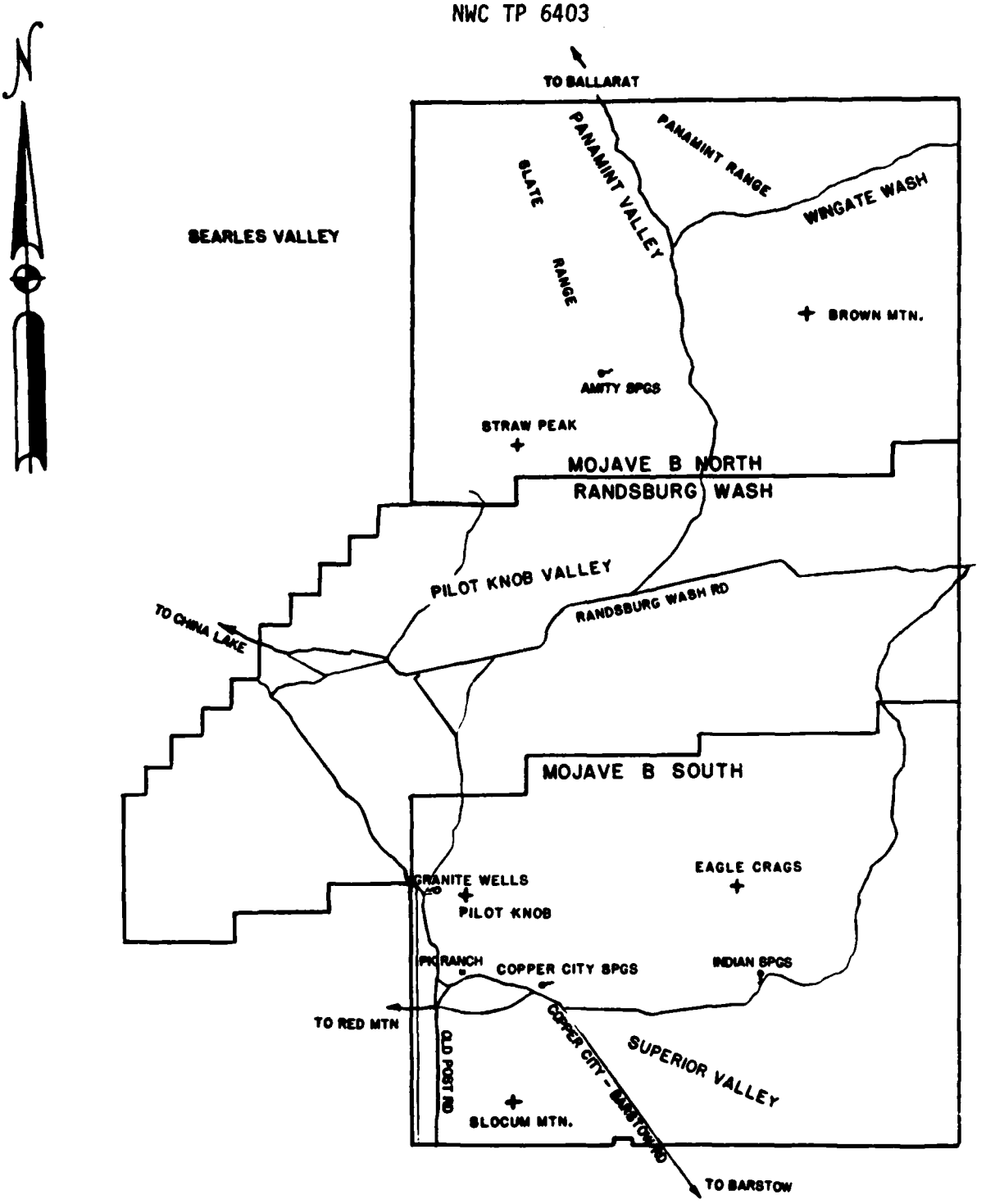


FIGURE 6-3 Major political and cultural features, Mojave B/Randsburg Wash Test Ranges.

In the north lie the Cosos, another prominent range of Mesozoic intrusives where elevations generally exceed 1830 m. (6000 ft.). Some Tertiary volcanics (basalt), however, are present southwest of Coso Peak. A small stand of Scpo occurs southeast of Coso Peak in the vicinity of Coso Village.

South of the main thrust of the Coso Range, the land levels off onto an extensive mesa cut in several locations by deep, narrow canyons which ultimately drain into Indian Wells Valley. The mesa stretches from the Coso Hot Springs area in the west to a chain of unnamed mountains in the east which border Etcheron Valley. This mesa, composed chiefly of Pleistocene volcanic basalts, provides an uncommon but not unique geological setting for S. polyancistrus. The frequency of this species increases significantly, however, on the higher terrain immediately surrounding the mesa to the north and east. Louisiana Butte is a conspicuous physiographic feature in this area. Here again, granitic (and some metavolcanics) are dominant. The soils on the eastern portion of the mesa (east of Renegade Canyon) are, in fact, composed chiefly of granite detritus originating from the unnamed mountains which form the eastern boundary of the mesa. Another population was found in this region.

The China Lake Test Complex provides a habitat for this species characteristic of populations found in the northern Mojave. Elevations range generally from 1460 to 1860 meters (4800-6100 ft.). Closed carcasses denoting infestation are prevalent. Coleogyne, Artemisia, Haplopappus, Ephedra, and Lycium are the dominant shrub complexes associated with Scpo.

6.2 Mojave B North Range

Two mountain ranges extend across the Mojave B North Range, the Slate Range in the west and the Panamint Range in the east. Between them lies Panamint Valley where elevations as low as 425 m. (1400 ft.) exist. The Slates are predominantly Mesozoic in origin (granite) and the Panamints are Tertiary volcanics. S. polyancistrus was not found on this test range.

6.3 Randsburg Wash Test Range

This range is located between the Mojave B North and Mojave B South Test Ranges. The range encompasses Pilot Knob Valley where elevations are generally less than 760 m. (2500 ft.). S. polyancistrus was not found on this test range.

6.4 Mojave B South Range

One large almost continuous population of Scpo exists in the western

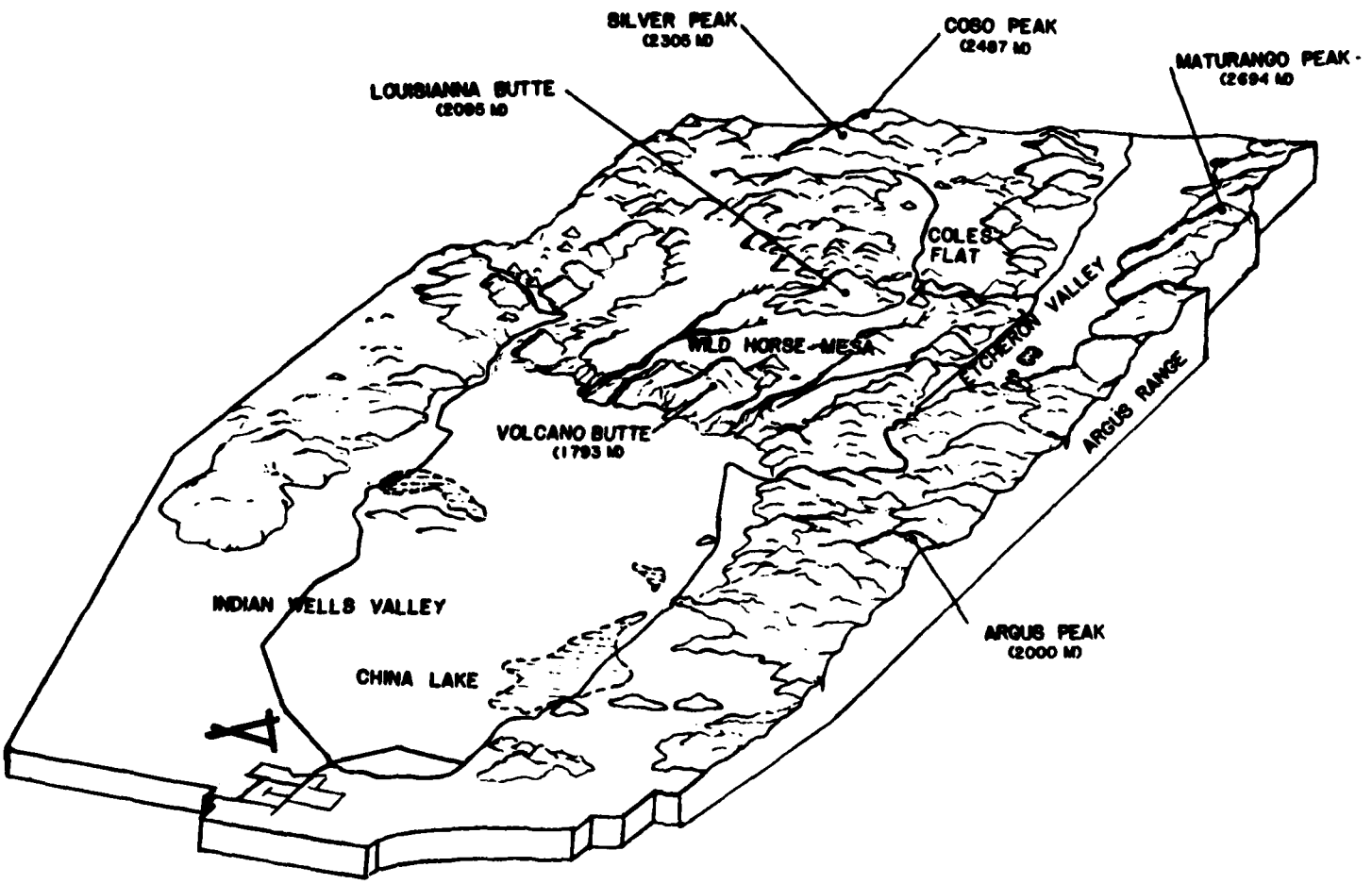


FIGURE 6-4 Physiography of the China Lake Test Complex.

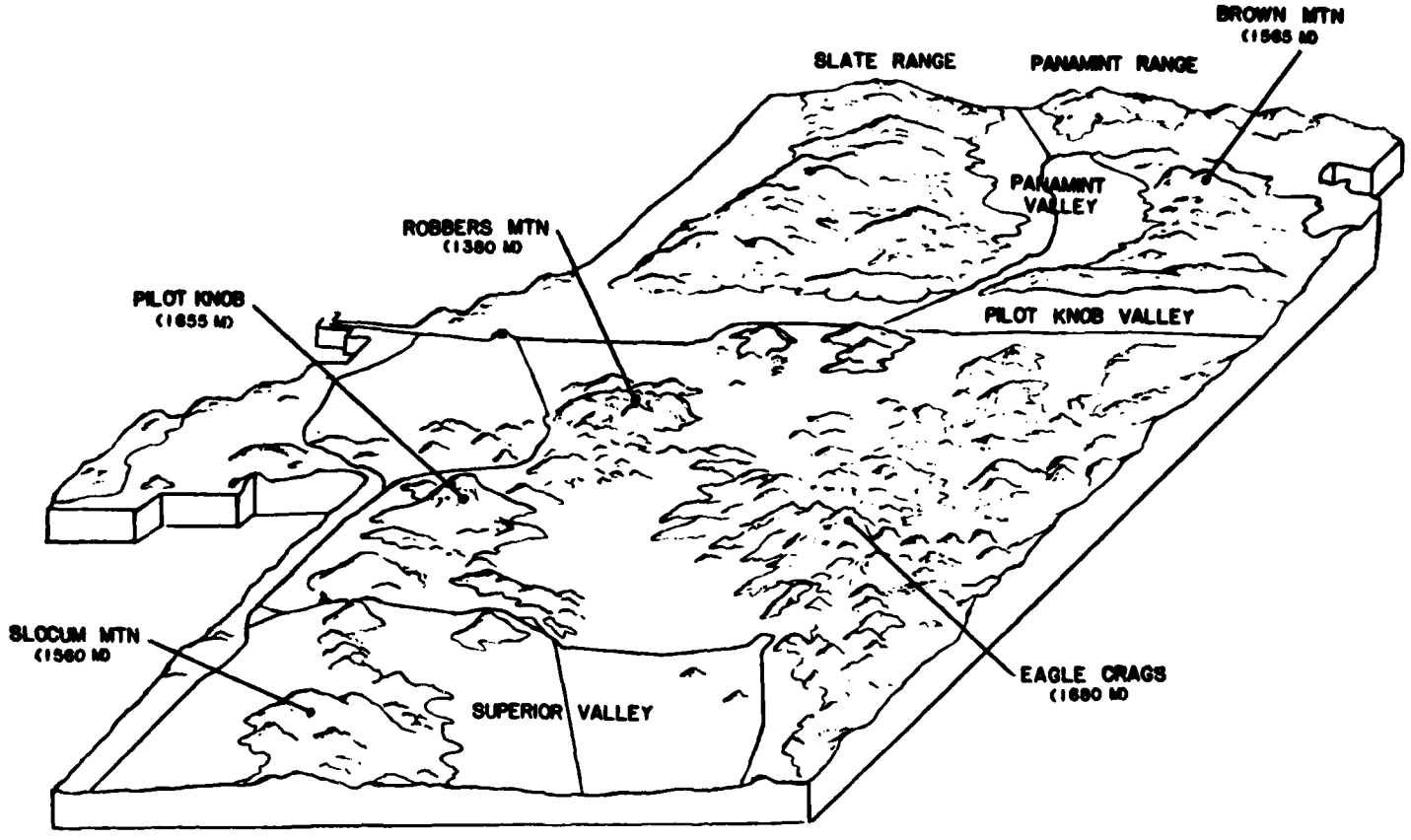


FIGURE 6-5 Physiography of the Mojave B/Randsburg Wash Test Ranges.

portion of the Mojave B South Range in an area predominantly composed of Mesozoic granitic rocks. In a few areas, the granite is overlain with patches of volcanic rock of Tertiary and Quaternary age which usually stand out as prominent knobs. Pilot Knob (1655 m.) is one such knob and is the dominant physiographic feature of this area. The east slopes of these hills form the western limit of Superior Valley.

The eastern portion of this range is predominantly Tertiary volcanics. The Eagle Crags, a series of volcanic peaks in this area, is a prominent landmark and is situated in a remote, virtually inaccessible region. A small population of Scpo was uncovered near Indian Springs, just south of the Crags where several volcanic ridges and shallow, wide washes emerge from the south flank of the mountain.

In contrast to the China Lake Test Complex, the Mojave B South Range provides a habitat for Scpo more typical of populations found in the southern Mojave. Elevations range from 1100-1350 m.(3600-4400 ft.). Shrub dominants within Scpo populations include Larrea, Grayia, and Lycium. Open carcasses, the result of small mammal predation, are a common occurrence.

7.0 NWC POPULATION DESCRIPTIONS & ASSESSMENTS

The following section describes the data collected from each population of S. polyancistrus surveyed.

In some areas on the NWC, the distribution of Scpo is almost continuous and probably represents one interbreeding unit or population. Using major physiographical features and uniform geological settings, however, the author has attempted, for discussion purposes, to arbitrarily name and segregate each area into separate and distinct local populations.

The China Lake Test Complex populations are discussed in Sections 7.1 through 7.7. The Mojave B South Range populations are covered in Sections 7.8 through 7.11.

It should be noted that it was not feasible to survey every region within the NWC likely to support populations of this cactus, particularly given the time and resources available. For this reason, potential range maps (Figures 7.1-1 through 7.11-4) have been compiled in an effort to identify such areas, particularly adjacent to those surveyed. It is hoped that these maps will provide a starting point should future fieldwork on the NWC relative to this species be conducted.

Tables 7.1-1 through 7.11-1 show size classifications of stems and age classifications of carcasses as a percentage of the total stems and carcasses found in each China Lake population.

7.1 Coso Village

General Description:

S. polyancistrus was found thinly distributed within the rocky valley bottom and rocky wash areas north and south of Coso Village. The majority were found in the shallow valley just north and northwest of the village. Two plants were found within the village proper. Scpo co-exists here with Coleogyne (dominant), Artemisia, Haplopappus, Hymenoclea, Ephedra, and Purshia.

Two distinct soil types in terms of color and porosity were noted in this area. Of particular interest was the affinity Scpo has with respect to one of these two subtrates: a light-colored and porous soil rich in gruss and granitic detritus. This soil type is derived from and is immediately adjacent to the white granite rock outcroppings which cover approximately 30% of this area. These rocks were found to contain a large percentage of orthoclase feldspars which, as a granite, weather more readily and often form well-drained soils. The remainder of the granite rocks present contain higher percentages of quartz and the soil associated with these rocks was darker in color[1] and appeared more compact. It would appear, based on the soil analysis data (Section 8.3), that there is no significant difference between the darker and lighter soils in terms of pH or the elemental p.p.m. content. It is therefore likely that the preference Scpo has for the lighter color soil is primarily due to soil porosity which, in general, may be more critical at higher elevations where precipitation is greater. In addition, the moderate to severe infestation observed to be present here may represent an additional selective factor: stems damaged by Moneilema larvae (see Section 8.1) are probably more susceptible to rot and no doubt fare better on well-drained substrates.

The Scpo population density in this area is very low and its occurrence is limited to the light-colored soils described above. It is likely that more Sclerocacti exist in the area and the northern limit of its range may extend beyond the NWC northern boundary.

1 The difference in iron content may at least partially account for the difference in soil color.

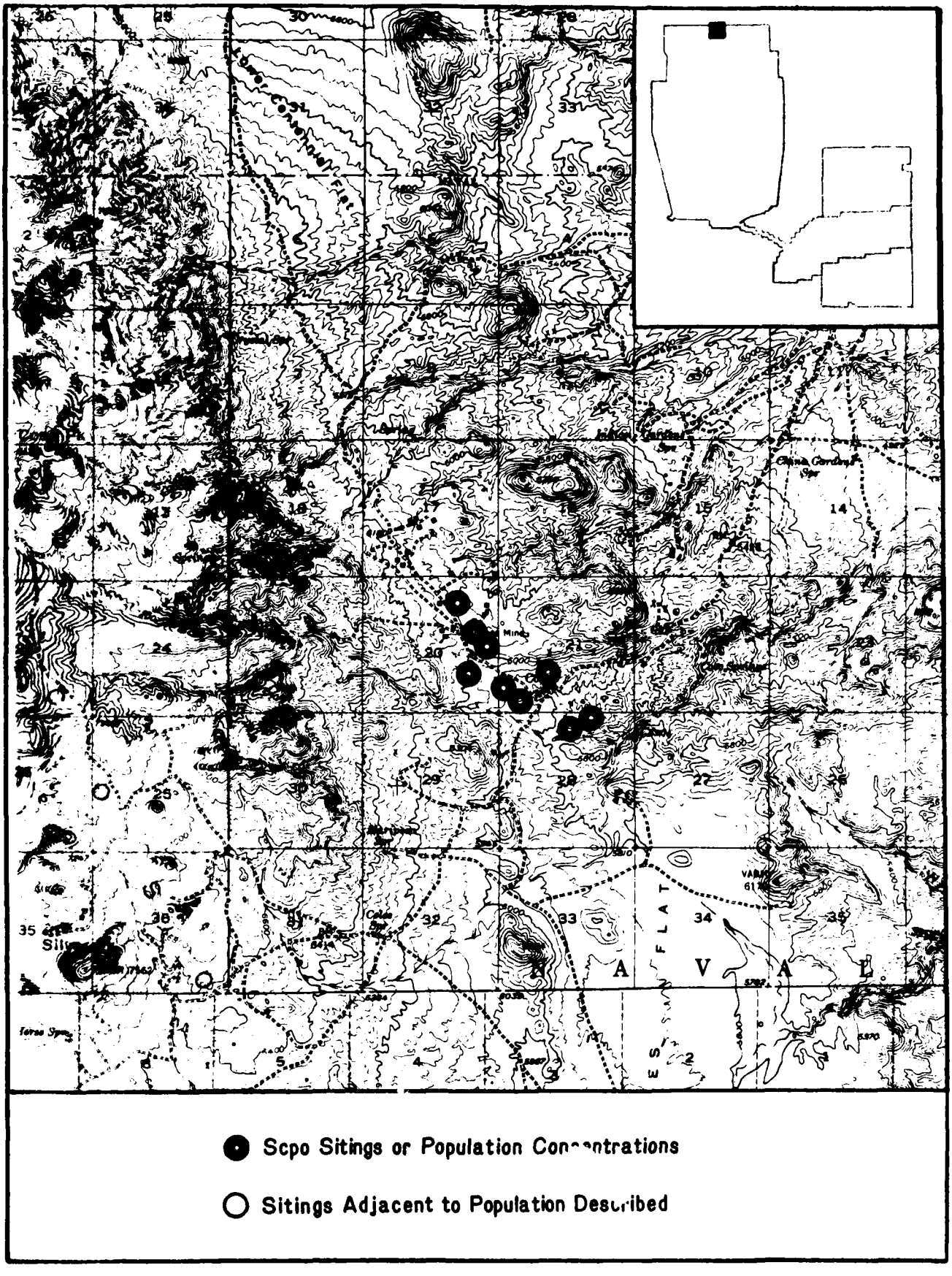


FIGURE 7.1-1 Scpo sitings and population concentrations in the Coso Village Area.

FIGURE 7.1-2 Habitat near Coso Village. Note white granite rock outcroppings.

LIVING STEMS		CARCASSES	
HEIGHT (cm.)	% OF TOTAL FOUND	ESTIMATED AGE	% OF TOTAL FOUND
≤2½(seedlings)	0	0-2 yrs	50
>2½-5	50		
>5-7½	13	2-4 yrs	33
>7½-10	25		
>10-12½	0		
>12½-15	0	4+ yrs	17
>15	12		

Carcass/Stem Ratio = 1.5

≤ = LESS THAN OR EQUAL TO
> = GREATER THAN

TABLE 7.1-1 Size classifications of stems and age classifications of carcasses as a percentage of the total stems/carcasses found, Coso Village.

SUMMARY DATA SHEET

COSO VILLAGE

DATE OF SURVEY: 1, 2 May 1982

LOCATION: Within and surrounding Coso Village, southeast of Coso Peak.
T20S, R40E, sections 20, 21, & N ½ sec. 28 (Coso Quad.)

PREVIOUS SITINGS:

"Carcass in canyon near Coso Springs"
(Unidentified NWC source)

HABITAT DESCRIPTION: Scpo thinly distributed on white granite derived soils; rocky washes in shallow valley. Shrubs relatively dense.

ASPECT: South

SLOPE: Slight, 0-10°

TOPO POSITION: Lower slopes of hills & in rocky washes

ELEVATION: 1740-1860 m.(5700-6100 ft.)

PLANT COMMUNITY: Coleogyne ramosissima, Artemisia tridentata, Eriogonum Kennedyi, Ephedra viridis, Ephedra nevadensis, Purshia glandulosa, Yucca brevifolia, Haplopappus linearifolius, Tetradymia sp.

GEOLOGICAL SETTING & SOILS: Mesozoic granite. Two types of granites found here; Scpo found in porous soil derived from granite high in orthoclase feldspars which covers about 30% of region; pH = 6.9 (one sample).

DENSITY/AREA: Generally less than 1/ha. Highest density found just northwest of Coso Village. Population covers a minimum of 3 km^2.

STEM COUNT: 8 **CARCASS COUNT:** 12 **TOTAL ESTIMATED:** 50

AGE CLASSIFICATIONS: Most stems small, less than 10 cm.; largest found:13½ cm.; 50% were less than 5 cm. tall

PHENOLOGY: In early bud; projected peak blooming period: last week in May or first week in June.

THREATS

NATURAL: Moderate - severe infestation(closed carcasses). Larvae collected.

MAN: None observed.

REMARKS: It is possible this population may extend further north to the NWC boundary. None were found in Coso Springs Canyon or on hills to the east. High altitude may contribute to low population densities.

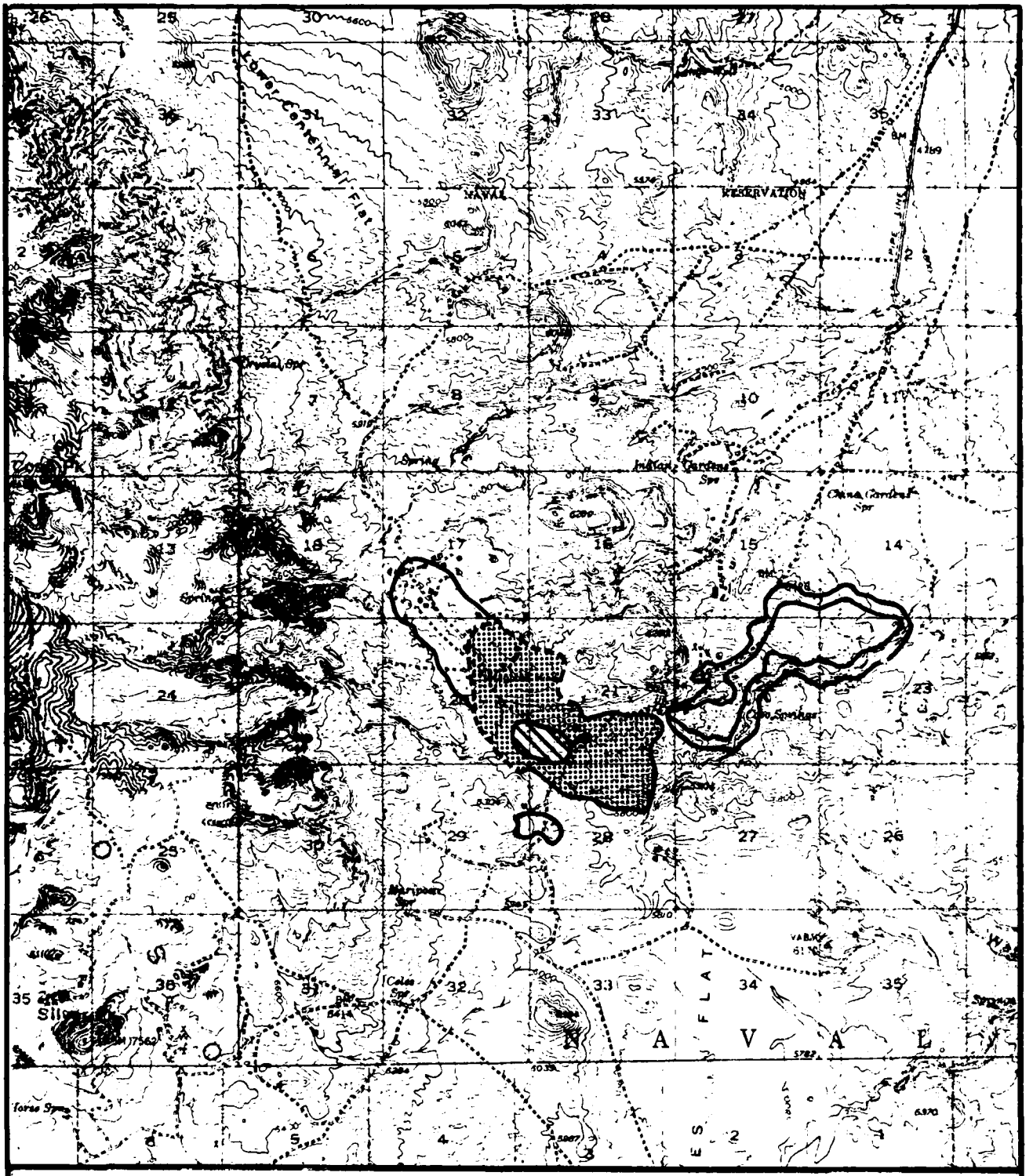


FIGURE 7.1-3 Estimated population densities and range, Coso Village area.

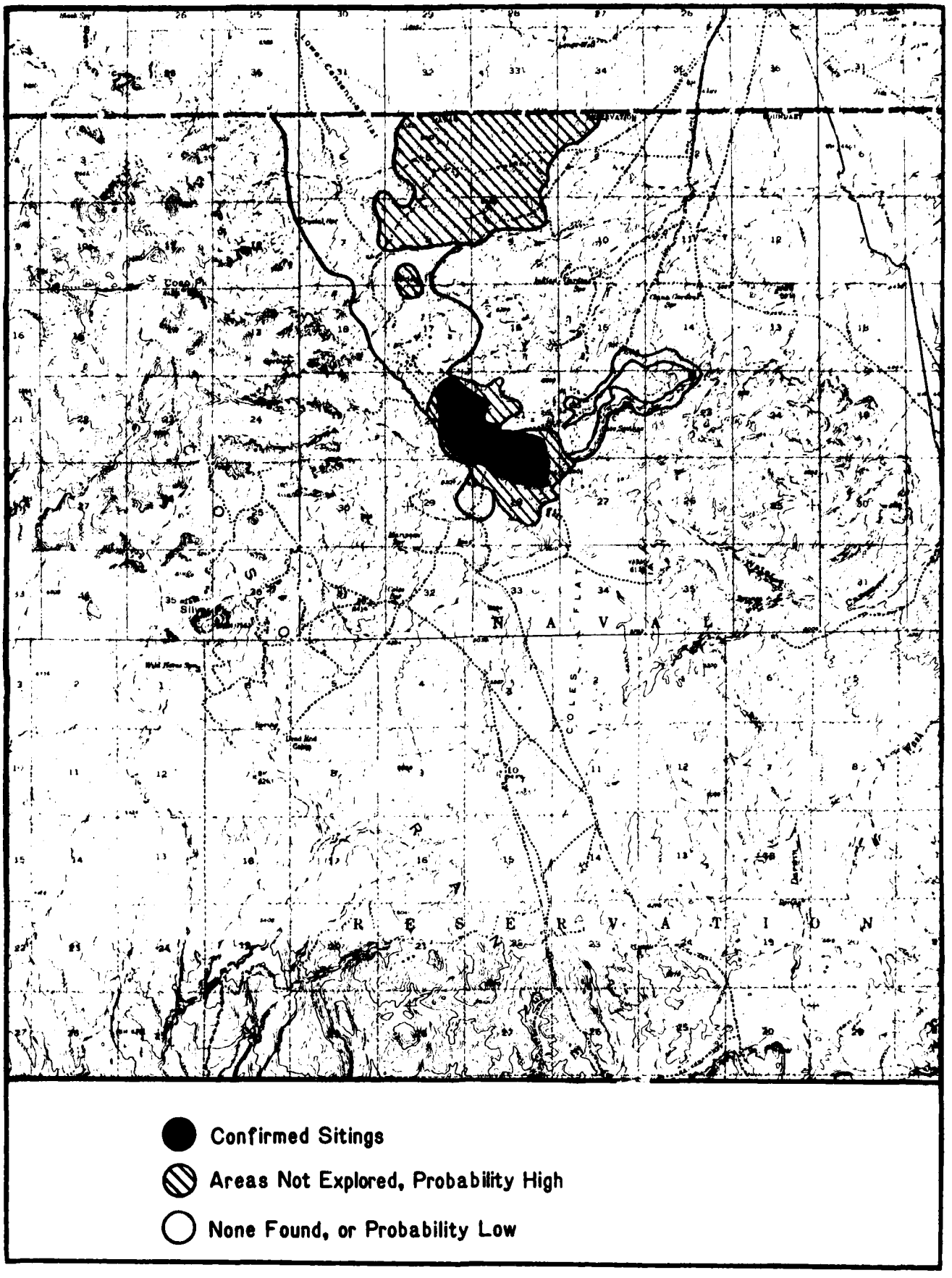


FIGURE 7.1-4 Potential range of Scpo in Coso Village area based on geological/ physiographical setting and visual observations.

7.2 Road to Big Petroglyph

General Description:

This population represents the most significant concentration of S. polyancistrus found during this NWC survey in terms of frequency and density. It is, in actuality, part of one almost continuous population which extends west across the mesa (Section 7.3) and south into the vicinity of Louisiana Butte (Section 7.4). The area is chiefly composed of granite and metamorphic (gneiss) rocks. Soils are rocky and appear well-drained.

Coleogyne, Artemisia, Grayia, and Ephedra are the dominant shrubs.

Most of the Sclerocacti were found on the hillsides immediately north of the dirt access road which leads to the Big Petroglyph area. At one location densities exceeded 5/ha. Scpo was also found in the hills further north (sections 25, 26, & 28).

Several dense groupings of stems were found beneath or immediately surrounding Joshua Trees (Y. brevifolia) and, in fact, there may be an association between the Joshua Tree and the local distribution of Scpo within this population.[1] This relationship could be the result of the habits of local species of fauna (probably birds) which frequent these trees and influence the seed dispersal process.[2] Survivability of seedlings under the cover of the trees may also be a factor.

It would appear that this population extends further north and northwest where the geological setting and elevations are similar.

It is recommended that this area be considered as a NWC refuge candidate for this species (see Section 9.0). This region also has aesthetic value and every effort should be made to leave this area undisturbed.

1 One such grouping consisting of ten stems was mapped for future study but has not been included within this report. Further study will be required to establish the validity of this relationship, a relationship which has not been recorded elsewhere.

2 Past field data indicates that the red fruits are, in fact, partially eaten or totally removed from the stem by predators.

Coso Quadrangle Map: T21S, R40E

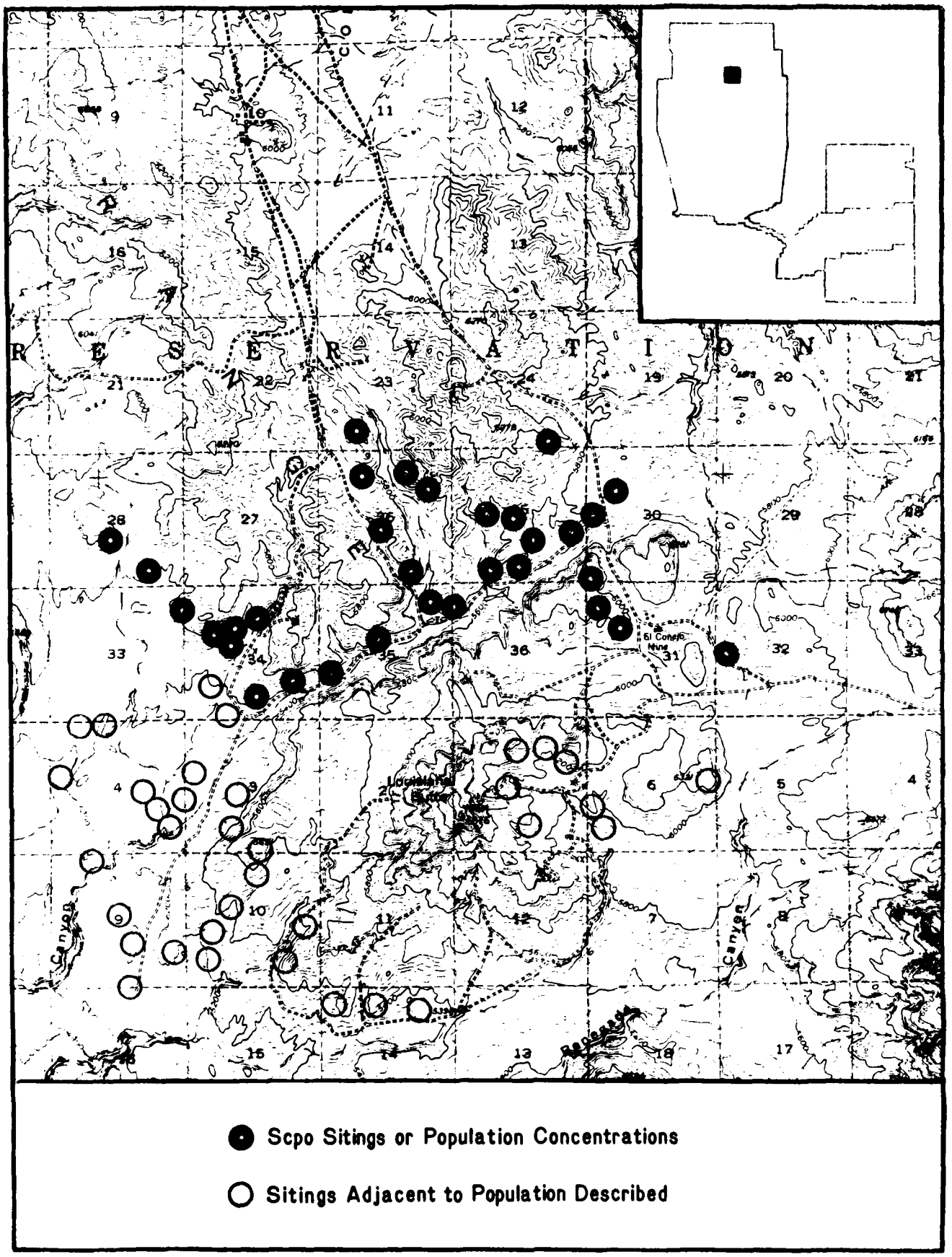


FIGURE 7.2-1 Scpo sitings and population concentrations, Rd. to Big Petroglyph Area.

FIGURE 7.2-2 Habitat adjacent access road (section 25) where the highest densities were recorded.

LIVING STEMS		CARCASSES	
HEIGHT (cm.)	% OF TOTAL FOUND	ESTIMATED AGE	% OF TOTAL FOUND
≤2½(seedlings)	10	0-2 yrs	32
>2½-5	16		
>5-7½	32	2-4 yrs	36
>7½-10	13		
>10-12½	7		
>12½-15	7	4+ yrs	32
>15	15		

Carcass/Stem Ratio = .25

≤ = LESS THAN OR EQUAL TO
> = GREATER THAN

TABLE 7.2-1 Size classifications of stems and age classifications of carcasses as a percentage of the total stems/carcasses found, Rd. to Big Petroglyph.

SUMMARY DATA SHEET

ROAD TO BIG PETROGLYPH

DATE OF SURVEY: 2, 22, and 27 May 1982

LOCATION: Hills north & northwest of Louisiana Butte; predominantly adjacent north side of access road to Big Petroglyph area.
T21S, R41E, E ½ sec.32 (near rd.), NW ¼ sec.31, W ½ sec.30 (Coso Quad.)
T21S, R40E, S ½ sec.24, sec.25, 26, 35, N ½ sec.36, S ½ sec.23, sec.34, S ½ sec.28, extreme NE corner, sec. 33.

PREVIOUS SITINGS:
T21S, R40E, S ½ sec.25 (Carolyn Sheppard, NWC, 1981)

HABITAT DESCRIPTION: Gentle sloping hills divided in several areas by wide sandy washes.

ASPECT: South and west

SLOPE: Slight to moderate, 40^{0} max.

TOPO POSITION: Lower slopes, occasionally on upper slopes and crest.

ELEVATION: 1645-1830 m. (5400-6000 ft.)

PLANT COMMUNITY: Coleogyne ramossisima, Artemisia tridentata, Haplopappus Cooperi, Ephedra nevadensis, Ephedra viridis, Grayia spinosa, Lycium Andersonii, Salazaria mexicana, Yucca brevifolia, Purshia glandulosa, Tetradymia sp.

GEOLOGICAL SETTING & SOILS: Chiefly Mesozoic granite & Pre-Cretaceous metamorphics, some basalts noted on north side of road just prior to point where road meets the mesa. Soils rocky; pH = 7.8 (one sample).

DENSITY/AREA: Relatively dense; significant concentrations just north of road on south slopes of hills. Densities here 3-5^{+}/ha; covers at least 7 km^{2}.

STEM COUNT: 111 **CARCASS COUNT:** 28 **TOTAL ESTIMATED:** 350

AGE CLASSIFICATIONS: All age classifications represented. Some very large stems in excess of 30 cm. noted in sec. 35, adjacent road.
PHENOLOGY: 2 May: late budding; 22 May: in full bloom; 27 May: late bloom.

THREATS

NATURAL: Light infestation

MAN: None observed.

REMARKS: This is a healthy stand of this cactus. Every effort should be made to leave this area undisturbed. Area has aesthetic value.
Population probably extends further north and west into sections 24, 21, 27 and 28.

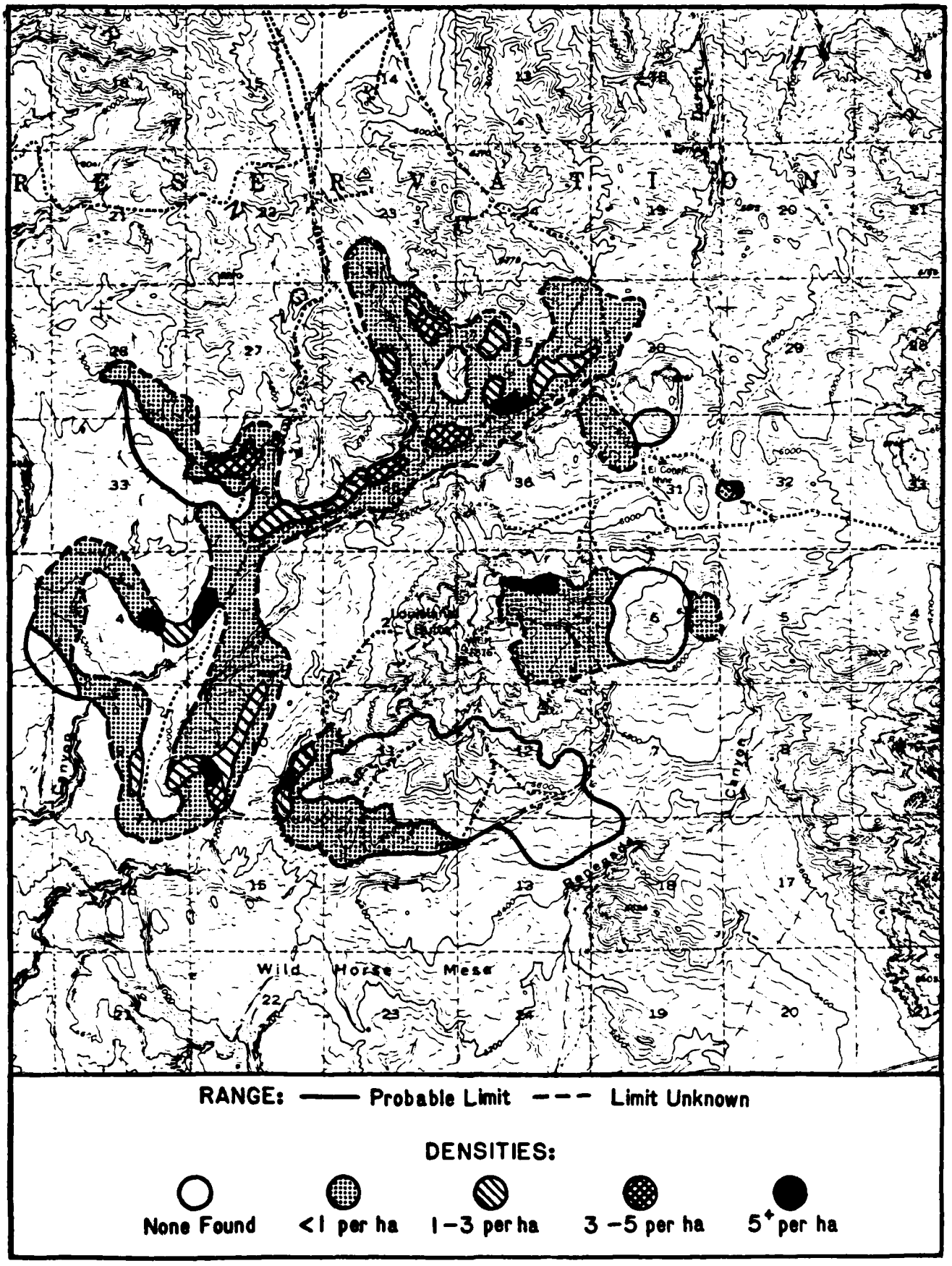


FIGURE 7.2-3 Estimated population densities and range, Road to Big Petroglyph and surrounding areas.

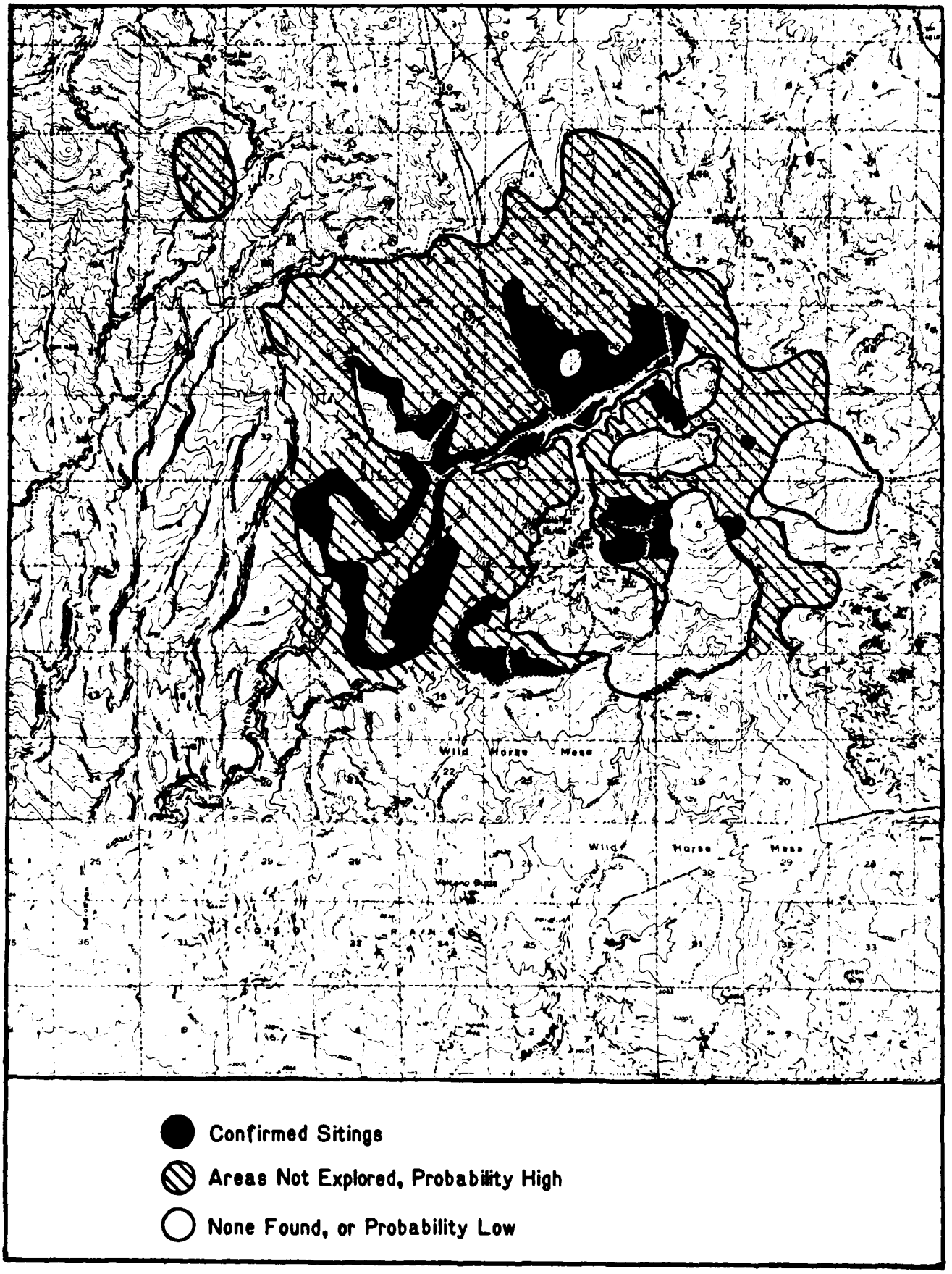


FIGURE 7.2-4 Potential range of Scpo in the Road to Big Petroglyph area based on geological/physiographical setting and visual observations.

7.3 Mesa

General Description:

This population is located on the mesa west of Louisiana Butte and is actually a continuation of the population described in Section 7.2. The geology and physiography in this region, however, is noticeably different. Volcanic ridges and outcroppings composed of Pleistocene basalts provide some relief to the otherwise flat terrain of the mesa and present an uncommon setting for this species. Scpo was most frequently found on these rocky basaltic outcroppings where, apparently, drainage is optimum.

The dominant shrubs in this area are Grayia, Coleogyne, Ephedra, and Haplopappus. The grasses (B. rubens and B. tectorum) were particularly dense.

The occurrence of Scpo in this area was found to diminish as one heads west and southwest across the mesa and away from the granite hills which border the mesa on the north and east.

A significant number of Sclerocacti were found in the southwest ¼ of section 10 and also on the east slopes of the 1940 m.(5691 ft.) ridge (granite) to the east of the dirt access road. Over half of the total stem count (139) can be attributed to the areas east of the road.

The majority of Sclerocacti within this population were found to be less than 15 cm. tall. A few stems were found over 20 cm. tall in section 10. Light infestation was noted.

It is recommended that this area be considered as a possible NWC refuge for this species, particularly sections 4 and 10 where several large concentrations were uncovered. Future fieldwork in this region, when possible, should be directed toward establishing whether Scpo exists farther west across the mesa.

Coso Quadrangle Map: T22S, R40E

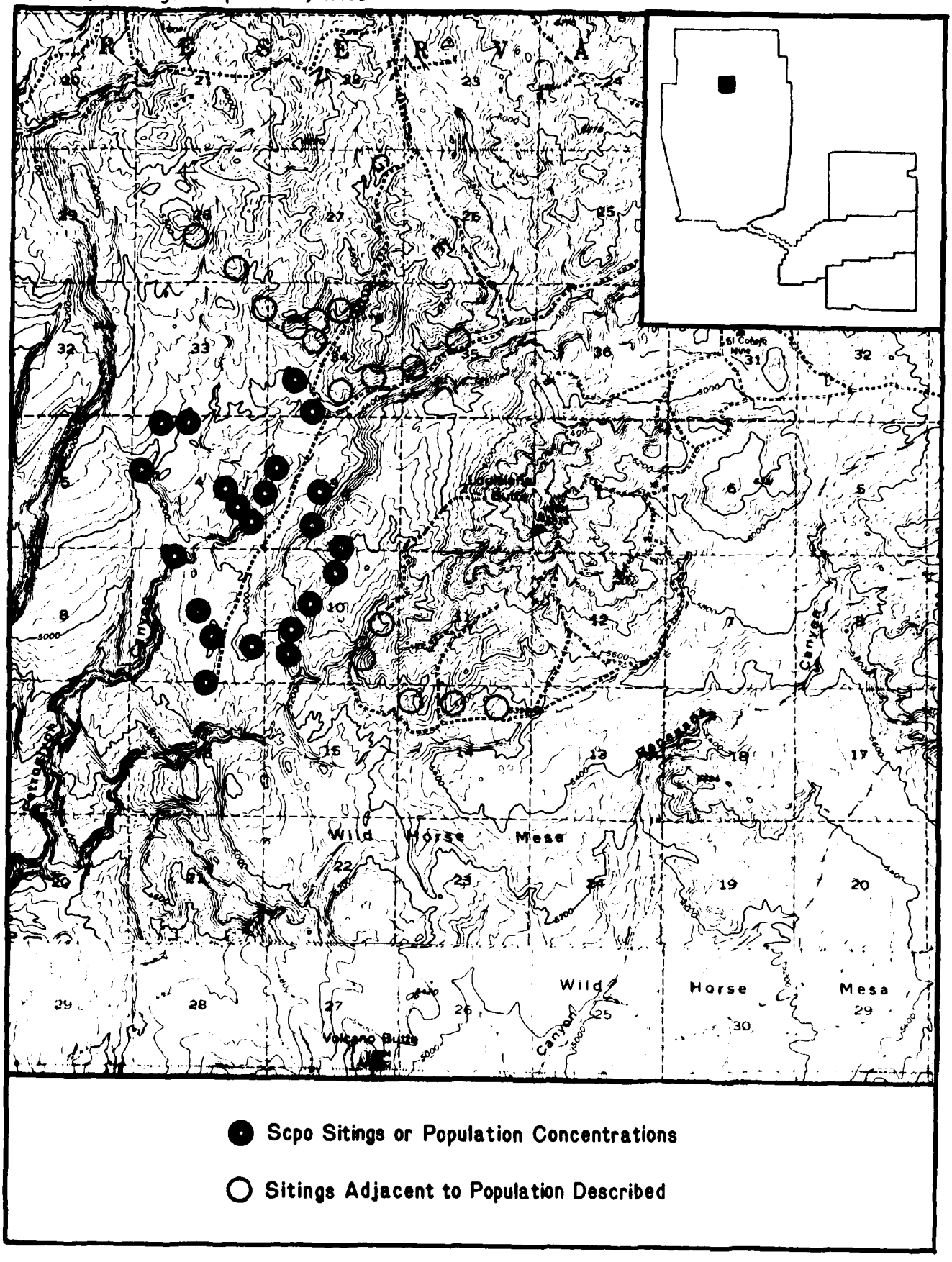


FIGURE 7.3-1 Scpo sitings and population concentrations in the Mesa area.

FIGURE 7.3-2 Typical basaltic rock outcropping on mesa (section 3); view looking southwest.

LIVING STEMS		CARCASSES	
HEIGHT (cm.)	% OF TOTAL FOUND	ESTIMATED AGE	% OF TOTAL FOUND
≤2½(seedlings)	1	0-2 yrs	40
>2½-5	6		
>5-7½	24	2-4 yrs	40
>7½-10	28		
>10-12½	14		
>12½-15	14	4+ yrs	20
>15	13		

Carcass/Stem Ratio = .07

≤ = LESS THAN OR EQUAL TO
> = GREATER THAN

TABLE 7.3-1 Size classifications of stems and age classifications of carcasses as a percentage of the total stems/carcasses found, Mesa area.

SUMMARY DATA SHEET

MESA

DATE OF SURVEY: 26 May 1982

LOCATION: Upper end of Petroglyph Canyon on Mesa.

T22S, R40E, sections 3,4,9,10,34 and northernmost portion, sec.16 (Coso Quad.).

PREVIOUS SITINGS:

T22S,R40E, E ½ sec.4, w ½ sec.3, N ½ sec.9.(Carolyn Sheppard, NWC, 1981)

HABITAT DESCRIPTION: Grassy mesa with basaltic rock outcroppings; several deep, narrow canyons cut through the area.

ASPECT: South

SLOPE: Slight, usually less than 25^{o}

TOPO POSITION: Occasionally on "flat" of Mesa, predominantly on crests and steeper slopes of outcroppings.

ELEVATION: 1555-1740 m. (5100-5700 ft.)

PLANT COMMUNITY: Coleogyne ramosissima(predominantly east of road), Ephedra nevadensis, Ephedra viridis, Haplopappus Cooperi, Grayia spinosa, Atriplex canescens, Yucca brevifolia, Tetradymia sp., Lycium sp., Eriogonum trichopes, Eriogonum fasciculatum.

GEOLOGICAL SETTING & SOILS: Basaltic rock of Quaternary age except on ridge east of road where rocks are chiefly granite. Soils light colored; pH = 7.2 (one sample).

DENSITY/AREA: Generally less than 1/ha. Several dense colonies(5^{+}/ha)are on rock outcroppings and in numerous locations within section 10. Covers at least 6 km^{2}.

STEM COUNT: 139 **CARCASS COUNT:** 10 **TOTAL ESTIMATED:** 300^{+}

AGE CLASSIFICATIONS: All age classifications represented. Oldest (largest) stems were found in section 10 east of the road.

PHENOLOGY: In late bloom.

THREATS

NATURAL: Light infestation

MAN: None observed.

REMARKS: It is difficult to determine, given the area surveyed, the full range of this population, particularly to the west across the mesa.

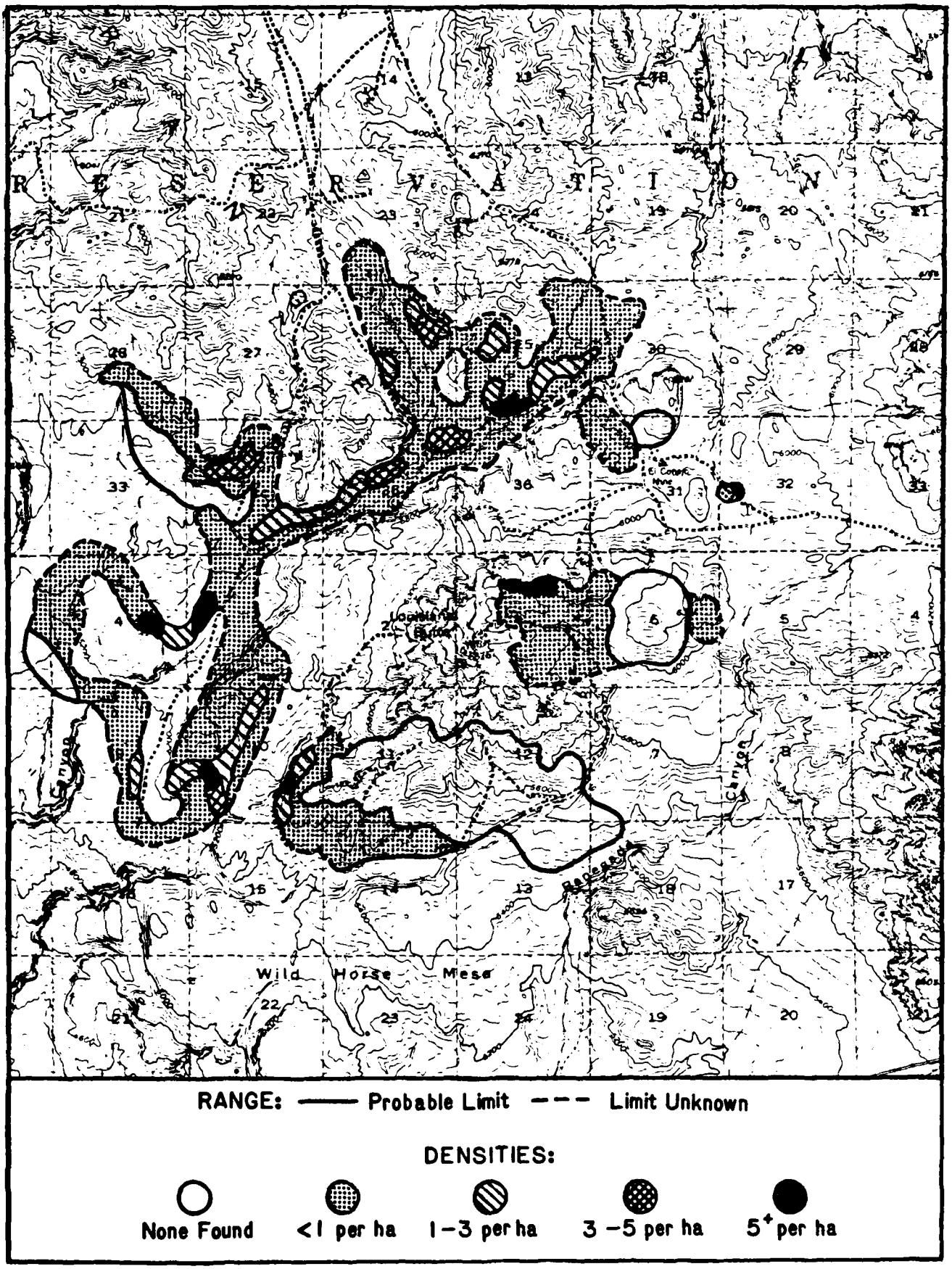


FIGURE 7.3-3 Estimated population densities and range, Mesa and surrounding areas.

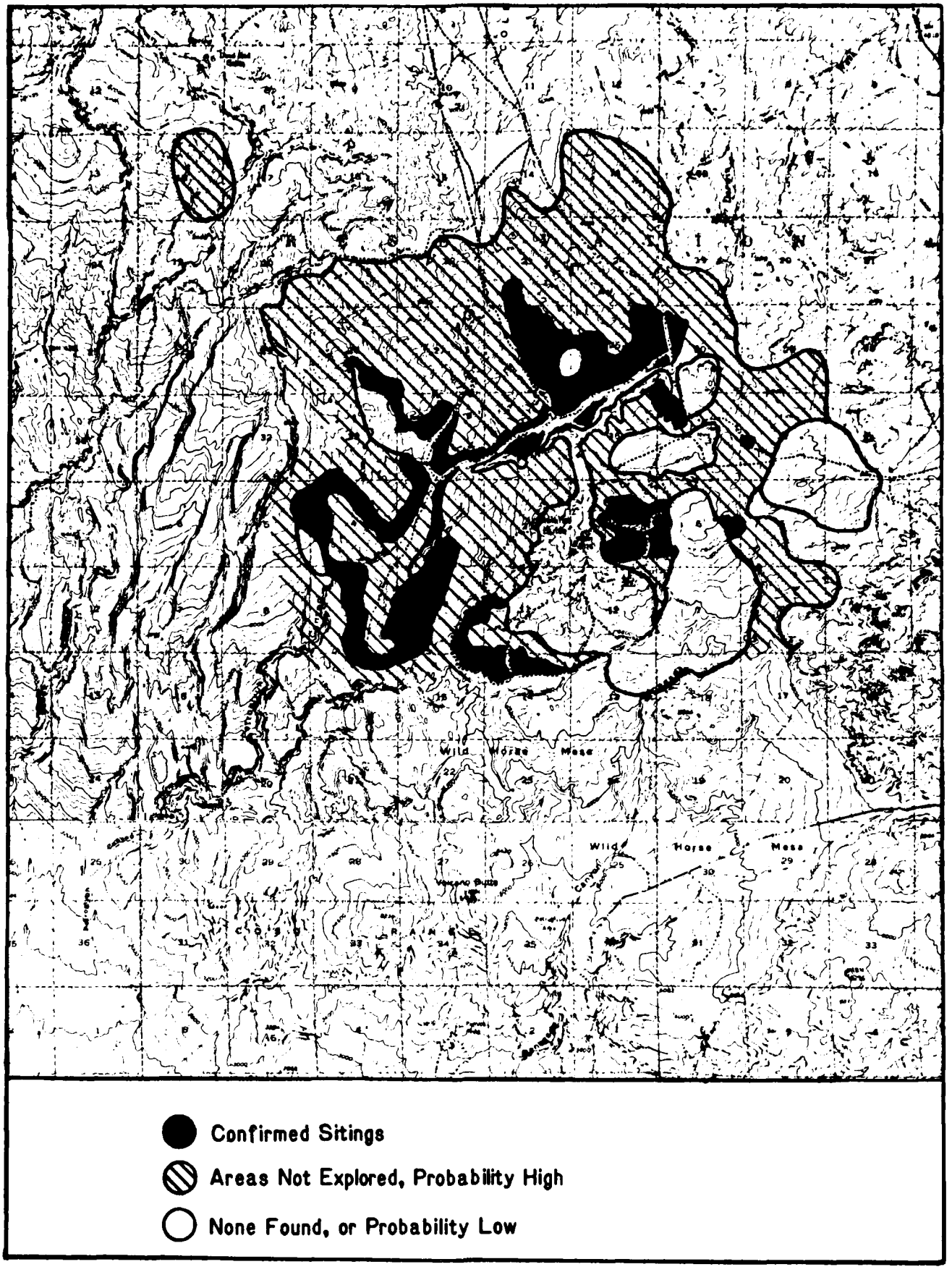


FIGURE 7.3-4 Potential range of Scpo in the Mesa area based on geological/ physiographical setting and visual observations.

7.4 Louisiana Butte

General Description

Louisiana Butte, a prominent feature of the region, consists primarily of granitic and metavolcanic rocks. With the exception of the north and northwest slopes, the foothills surrounding the mountain were reasonably well surveyed. Several colonies of Scpo were found on the west and south facing slopes of these foothills. The plant community in this area is dominanted by Coleogyne, Atriplex, Haplopappus, and Ephedra.

On the east flank, a major concentration of Scpo was uncovered in section 1 on the south slopes of a granitic ridge which extends east into section 6. This colony is of great interest; several stems were observed to have almost totally white blooms, possibly the result of a recessive gene uncovered by localized genetic inbreeding. Scpo was not found on the red soils associated with the large volcanic dome in the center of section 6. Further east, however, the granite derived soils and the occurrence of Scpo resume and probably continue to the southeast and adjoin the population on east Wild Horse Mesa (Section 7.5).

Scpo was not found on the south slopes of Louisiana Butte where a somewhat different, more compact soil type was encountered.

On the west and southwest slopes Scpo was again found thinly distributed on the low hills and ridges present here. One relatively dense colony was noted in the southeast corner of section 10.

It is likely that Scpo exists further north at the base of this mountain in sections 2 and 36.

The stems found here were in late bloom. Although some evidence of infestation was noted, most of the plants appeared healthy and robust.

Coso Quadrangle Map: T22S, R40E

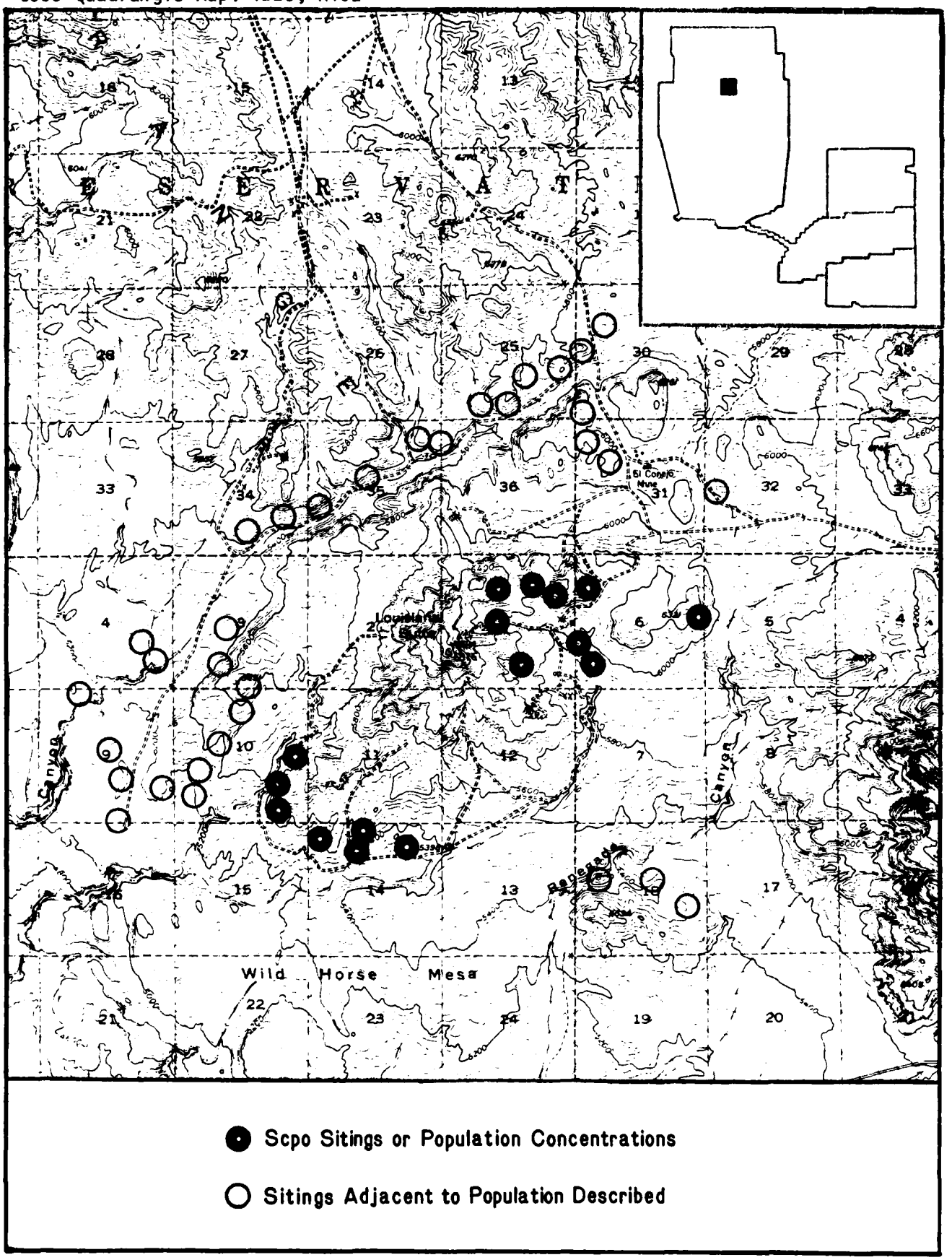


FIGURE 7.4-1 Scpo sitings and population concentrations in the Louisiana Butte area.

FIGURE 7.4-2 S. polyancistrus with "white" blooms in habitat, east flank of Louisiana Butte.

LIVING STEMS		CARCASSES	
HEIGHT (cm.)	% OF TOTAL FOUND	ESTIMATED AGE	% OF TOTAL FOUND
≤2½(seedlings)	2	0-2 yrs	0
>2½-5	17		
>5-7½	25	2-4 yrs	25
>7½-10	21		
>10-12½	12		
>12½-15	14	4^+ yrs	75
>15	9		

Carcass/Stem Ratio = .07

≤ = LESS THAN OR EQUAL TO
> = GREATER THAN

TABLE 7.4-1 Size classifications of stems and age classifications of carcasses as a percentage of the total stems/carcasses found, Louisiana Butte.

SUMMARY DATA SHEET

LOUISIANA BUTTE

DATE OF SURVEY: 29, 30 May 1982

LOCATION: North of Wild Horse Mesa on the west and east slopes of Louisiana Butte.

T22S, R40E, E ½ sec.10, E ½ sec.1, W ½ sec.11, N ½ sec.14 (Coso Quad.)
T22S, R41E, sec.6, extreme W sec.5

PREVIOUS SITINGS:

None

HABITAT DESCRIPTION: Low rolling foothills at the base of Louisiana Butte; south and southwest facing slopes. Rocky soils, primarily granite.

ASPECT: Generally south and southwest

SLOPE: Slight-moderate, 45^{o} max.

TOPO POSITION: Lower-middle & upper slopes

ELEVATION: 1650-1950 m. (5300-6400 ft.)

PLANT COMMUNITY: Coleogyne ramosissima, Ephedra nevadensis, Ephedra viridis, Atriplex canescens, Haplopappus Cooperi, Haplopappus linearifolius, Salazaria mexicana, Hymenoclea salsola, Yucca brevifolia, Lycium Cooperi, Purshia glandulosa, Eriogonum nudum, Tetradymia sp.

GEOLOGICAL SETTING & SOILS: Chiefly Mesozoic granite, some metavolcanics mainly on the south slopes of Louisiana Butte. Soils rocky, light colored.

DENSITY/AREA: Generally less than 1/ha. Largest concentrations located just east of Louisiana Butte (5^{+}/ha) and on the west flank in section 10 (3-5/ha). Covers 5 km^{2}.

STEM COUNT: 57 **CARCASS COUNT:** 4 **TOTAL ESTIMATED:** 100

AGE CLASSIFICATIONS: All age classifications represented.

PHENOLOGY: In late bloom.

THREATS

NATURAL: Light infestation

MAN: None observed

REMARKS: The east flank population is significant and probably extends southeast becoming part of East Wild Horse Mesa population. More colonies likely in NW ¼ sec.11 and in section 2 west of Louisiana Butte.

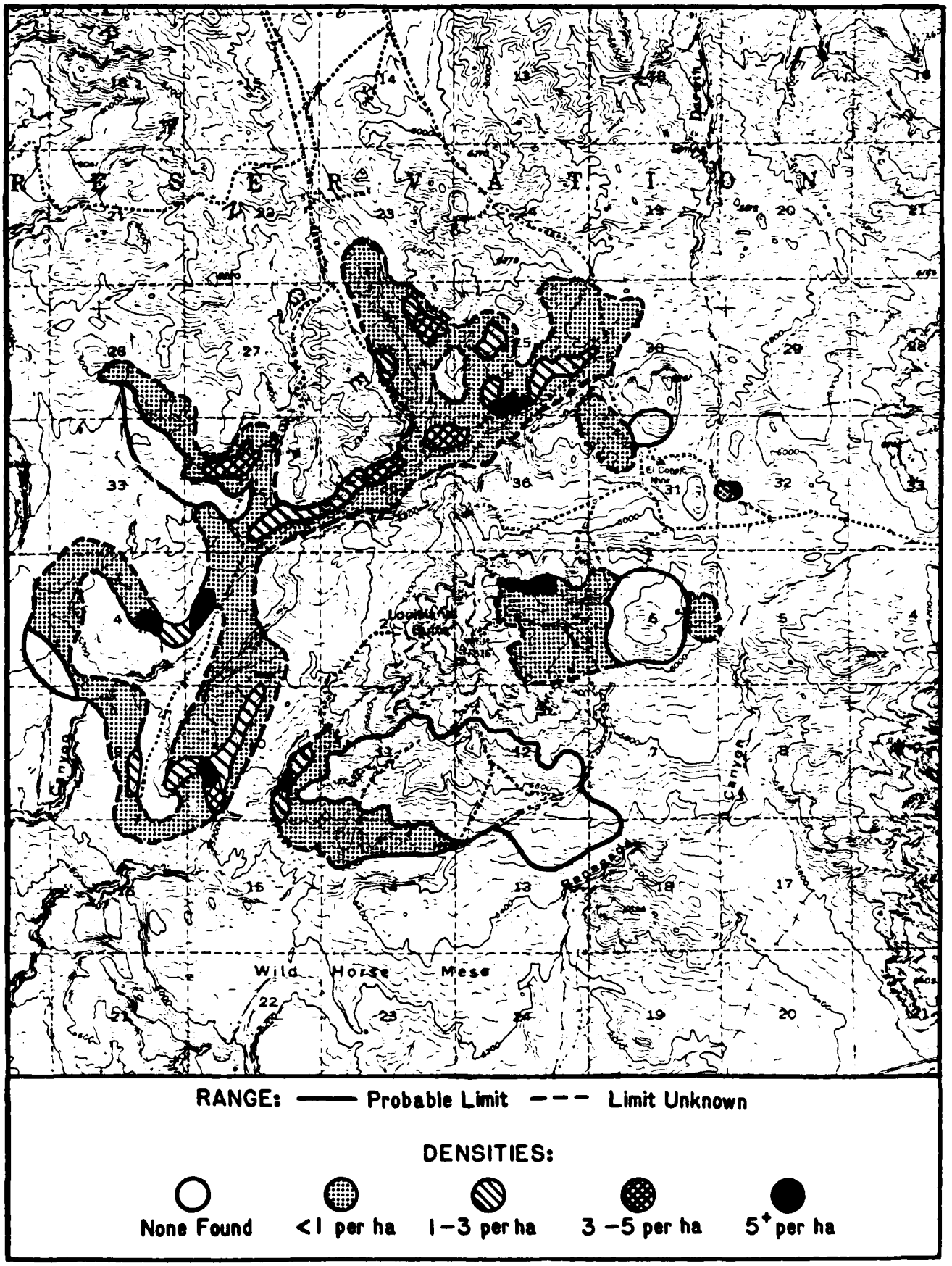


FIGURE 7.4-3 Estimated population densities and range, Louisiana Butte and surrounding areas.

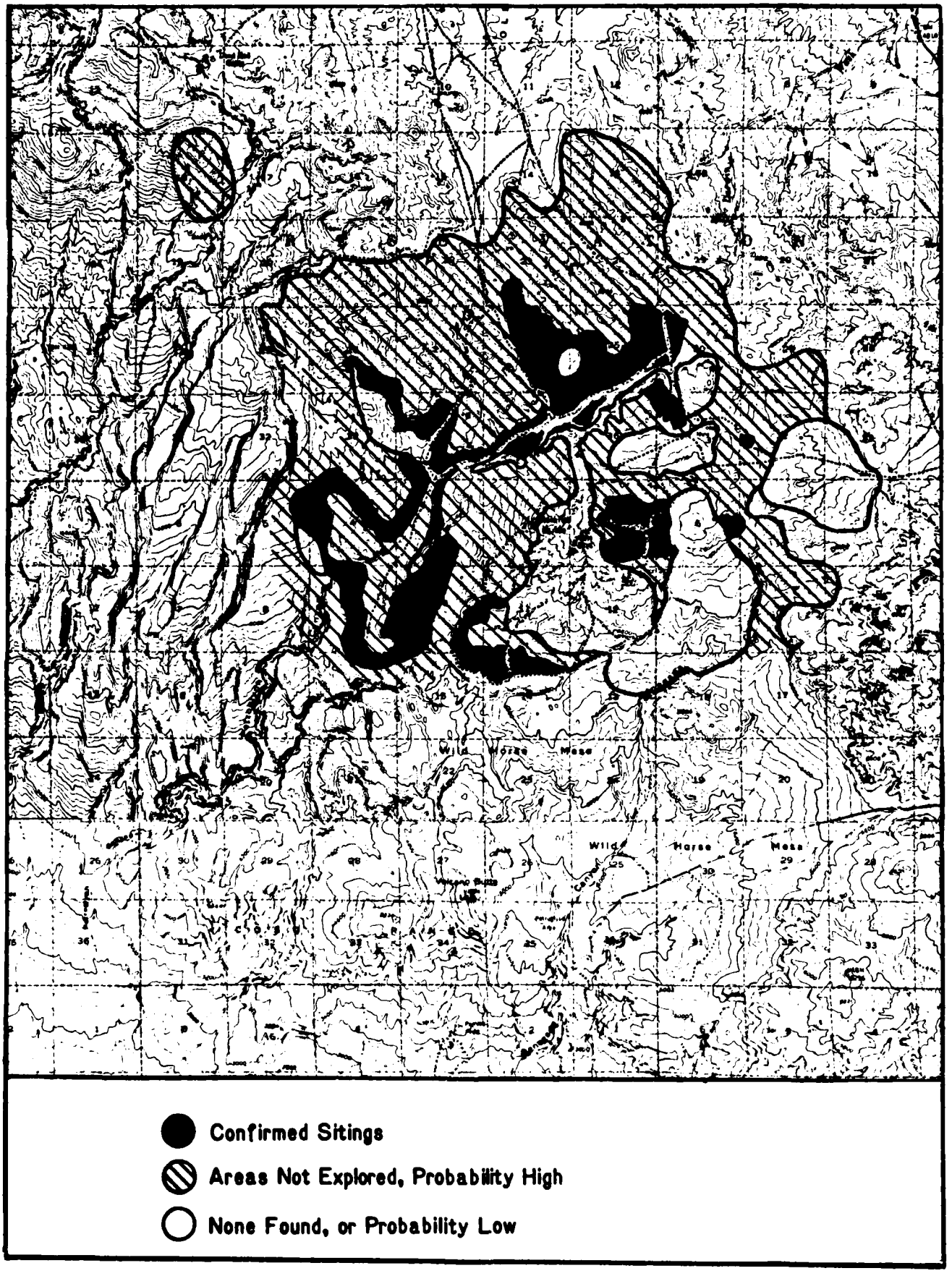


FIGURE 7.4-4 Potential range of Scpo in the Louisiana Butte area based on geological and physiographical setting and visual observations.

7.5 East Wild Horse Mesa

General Description:

The eastern boundary of Wild Horse Mesa is marked by a prominent range of mountains composed of Mesozoic granites. These mountains have produced an extensive bajada composed of granitic detritus sweeping west and south from the foothills. Soils are porous and well suited for this species. The dominant shrub in this area is Coleogyne ramosissima.[1]

Scpo was found thinly distributed over this bajada, particularly in section 17 where a large wash emerges from the base of the mountains. Further west, Scpo was also found on the north side of two hills just east of upper Renegade Canyon (sections 18 & 19). Although this species had been reported by a reliable source in sections 19 and 24, none were found in this area during the survey and were probably missed.

It is likely that this population is part of one continuous distribution within this area extending north into sections 8 and 5. Scpo has already been confirmed along the eastern boundary of section 6, east of Louisiana Butte (see Section 7.4). One stem was found 50 m. north of the road in section 21 and it is therefore likely that at least a few Sclerocacti exist south of the road in sections 28 and 29. During the survey of South Wild Horse Mesa (Section 7.6), none were found in sections 32 or 31 and, therefore, it is likely that this population's southern limit is not far from the road.

Some of the specimens found here were relatively large (over 20 cm.). Light-moderate infestation was noted as evidenced by the presence of closed carcasses. Most of the stems appeared healthy and were in late bloom.

1 It is interesting to note the preference this shrub has for porous, granite derived soils which were present here. This becomes more evident in areas where there is a sharp division between the volcanic (basaltic) settings and the granites, as in the case in section 24 along upper Renegade Canyon and on south Wild Horse Mesa in section 36.

Coso Quadrangle Map: T22S, R41E

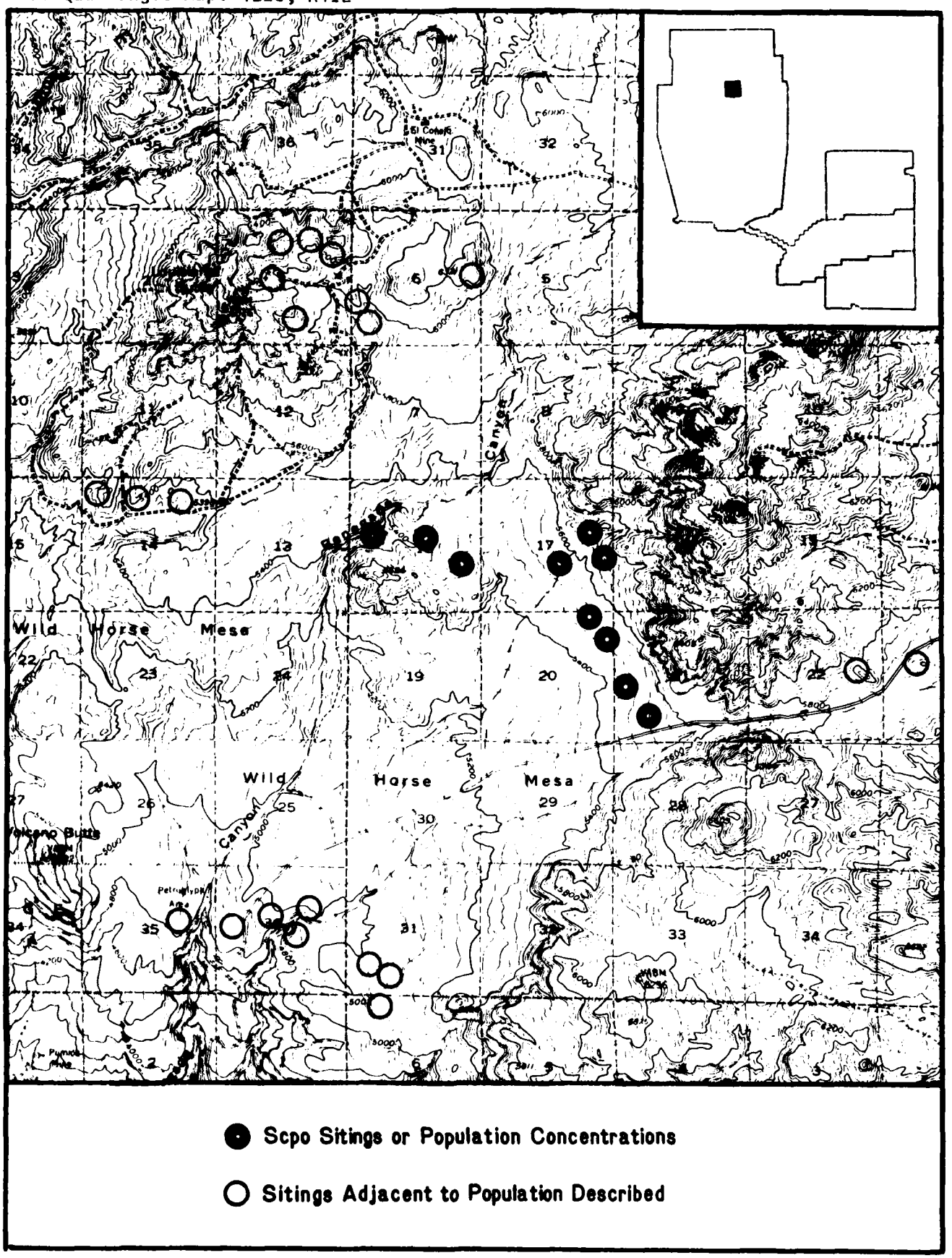


FIGURE 7.5-1 Scpo sitings and population concentrations on East Wild Horse Mesa.

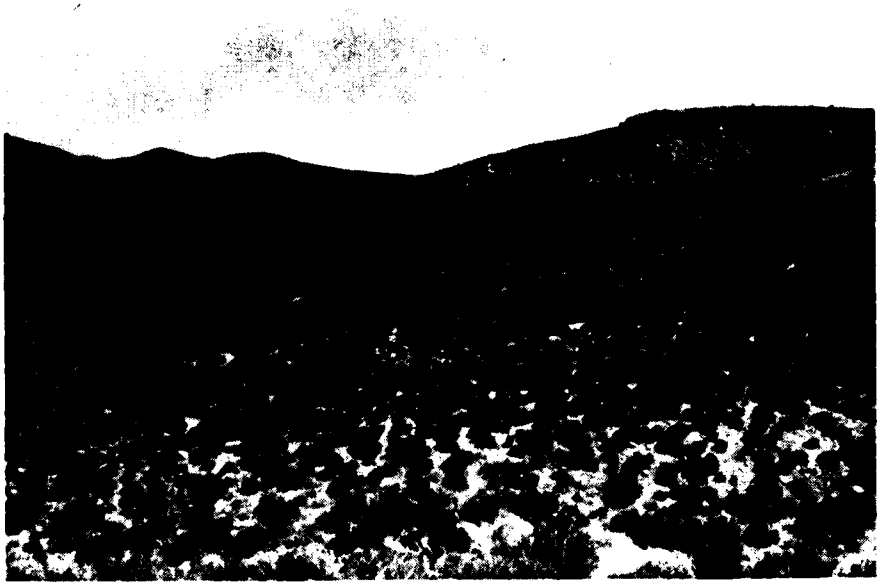


FIGURE 7.5-2 Foothills of granitic mountains along eastern edge of Wild Horse Mesa (view looking north in section 17).

LIVING STEMS		CARCASSES	
HEIGHT (cm.)	% OF TOTAL FOUND	ESTIMATED AGE	% OF TOTAL FOUND
≤2½(seedlings)	0	0-2 yrs	22
>2½-5	19		
>5-7½	31	2-4 yrs	44
>7½-10	29		
>10-12½	14		
>12½-15	2	4+ yrs	34
>15	5		

Carcass/Stem Ratio: .21

≤ = LESS THAN OR EQUAL TO
> = GREATER THAN

TABLE 7.5-1 Size classifications of stems and age classifications of carcasses as a percentage of the total stems/carcasses found, East Wild Horse Mesa.

SUMMARY DATA SHEET

EAST WILD HORSE MESA

DATE OF SURVEY: 12, 29, 30 May 1982

LOCATION: Upper end of Renegade Canyon and extreme eastern portion of Wild Horse Mesa.

T22S, R41E, sec.17, 18, E ½ sec.20, W ½ sec.21(Coso Quad.)

PREVIOUS SITINGS:

T22S, R40E, E ½ sec.24
T22S. R41E, W ½ sec.19, sec.18
(Mary Ann Henry, China Lake, Ca., 24 May 1981)

HABITAT DESCRIPTION: Gentle sloping bajada and low rolling hills; soils rocky and porous.

ASPECT: West

SLOPE: Slight, 5-30^{o}

TOPO POSITION: Bajada and lower slopes of hills

ELEVATION: 1645-1740 m. (5400-5700 ft.)

PLANT COMMUNITY: Coleogyne ramosissima, Grayia spinosa, Hymenoclea salsola, Ephedra nevadensis, Ephedra viridis, Salazaria mexicana, Haplopappus Cooperi, Haplopappus linearifolius, Lycium Cooperi, Yucca brevifolia, Purshia glandulosa.

GEOLOGICAL SETTING & SOILS: Mesozoic granite. Soils contain granitic detritus and are very porous; pH = 7.2 (one sample).

DENSITY/AREA: Generally less than 1/ha. Higher densities noted in sec. 17 & 18. Population covers approx. 4 km^2.

STEM COUNT: 42 **CARCASS COUNT:** 9 **TOTAL ESTIMATED:** 150

AGE CLASSIFICATIONS: All age classifications represented. Several large (old) stems up to 25 cm. were noted in sec.17 & 20.

PHENOLOGY: Late blooming period

THREATS

NATURAL: Light-moderate infestation

MAN: None observed

REMARKS: This population very likely extends north across the bajada into sec.8. Although none were found in sec. 24(R40E) and 19(R41E), it is likely that Scpo exists here based on a previous siting.

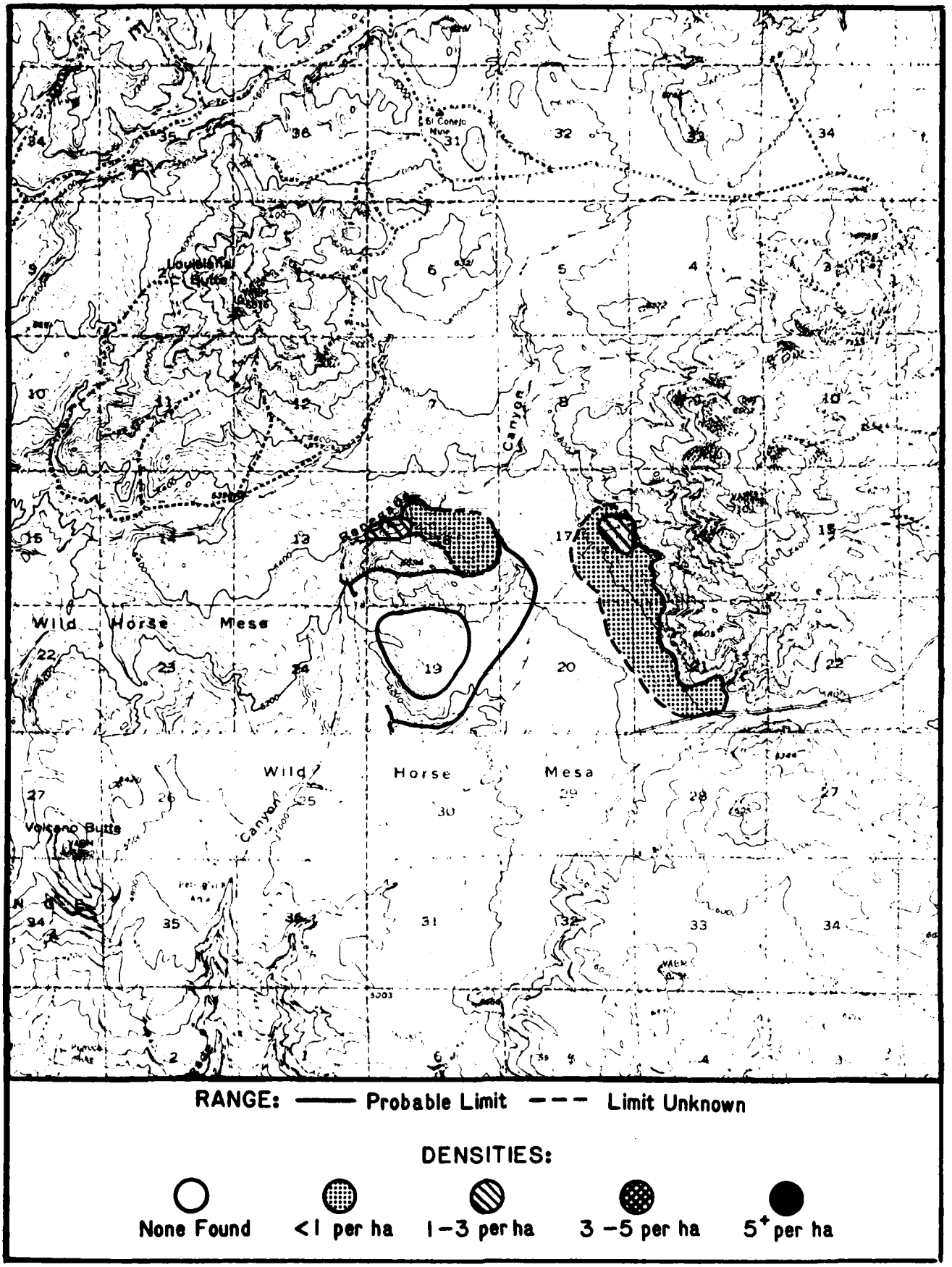


FIGURE 7.5-3 Estimated population densities and range, East Wild Horse Mesa.

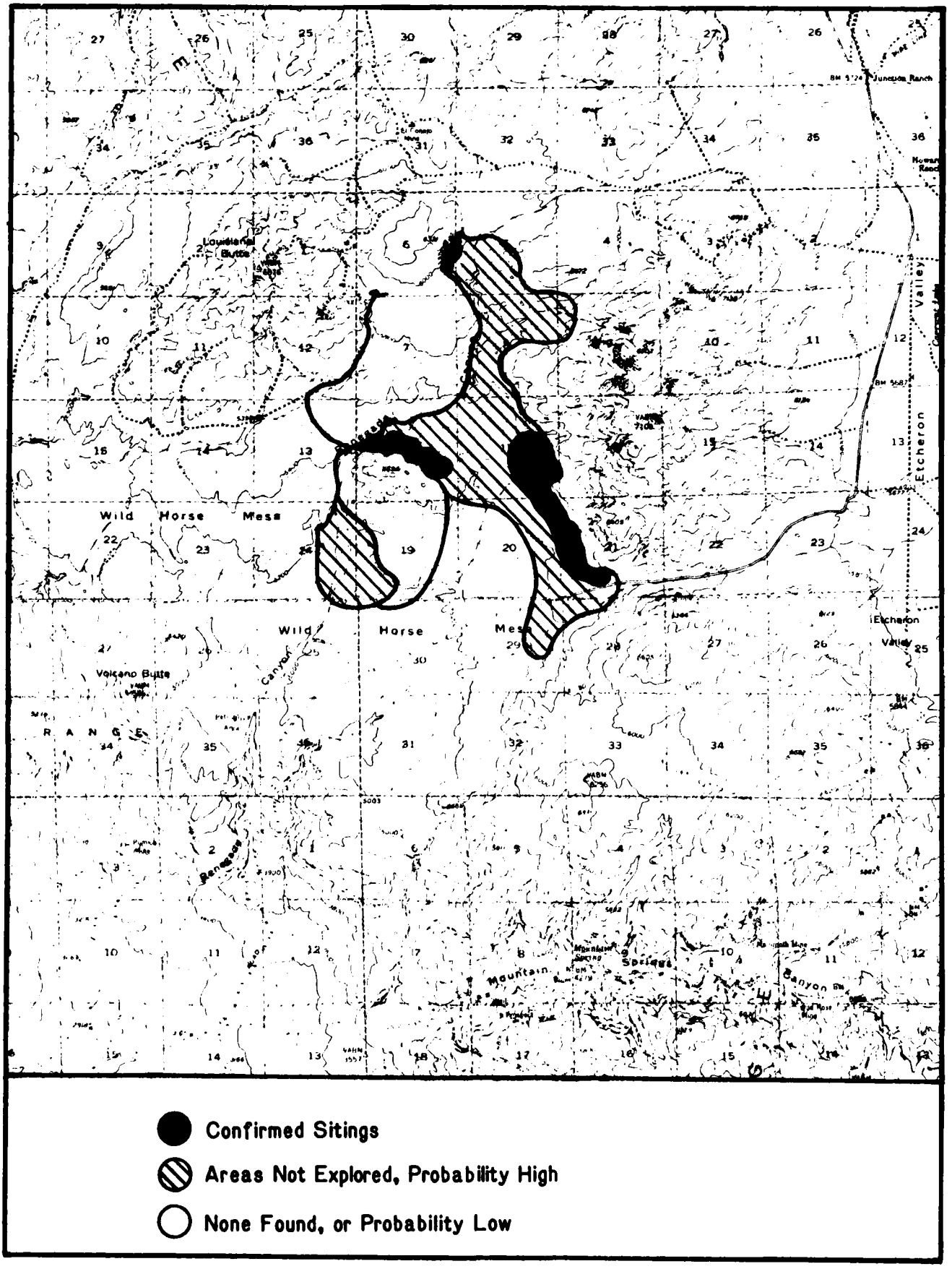


FIGURE 7.5-4 Potential range of Scpo in the East Wild Horse Mesa area based on geological/physiographical setting and visual observations.

7.6 South Wild Horse Mesa

General Description:

S. polyancistrus was found at the extreme southern end of Wild Horse Mesa, very thinly distributed over the ridges and volcanic rock outcroppings present here. This area is very similiar in terms of geological setting and soils to the mesa area described in Section 7.3. Shrub dominants include Lycium, Haplopappus, and Hymenoclea.

Most of the Sclerocacti were found at the very edge of the mesa just before the land drops off into Indian Wells Valley to the south. It is possible that others may be present on the downslope, particularly in the prominent wash area in sections 6 and 7. Scpo has also been reported in the southwest corner of section 25; however, none were found during the course of this survey. As one heads north and west (out of section 35), the frequency of Scpo decreases drastically. None were found in sections 23 and 26.

The occurrence of several closed carcasses and damaged stems indicates the presence of infestation in this area. More significant, however, is the impact feral burro grazing has had on the flora and soils present here. This subject is covered in more depth in Section 8.2.

The population as a whole appeared to be in a very tenuous state of existence. Several stems were found which appeared to be under severe stress. All of the 21 stems found were less than 10 cm. in height. It is recommended that the status of this population be monitored closely, particularly with respect to the effects the burro removal program may have on a recovery.

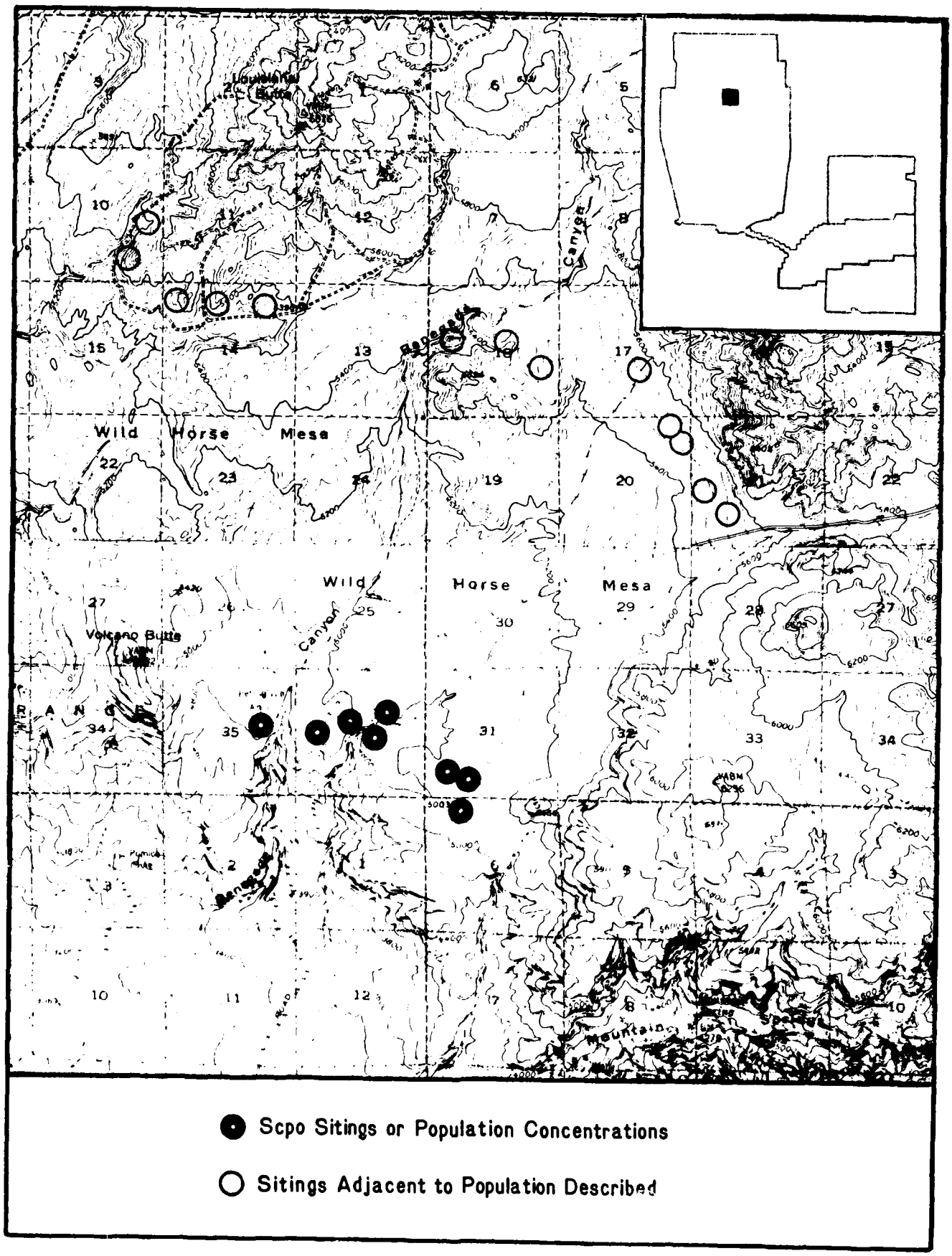


FIGURE 7.6-1 Scpo sitings and population concentrations in the South Wild Horse Mesa area.

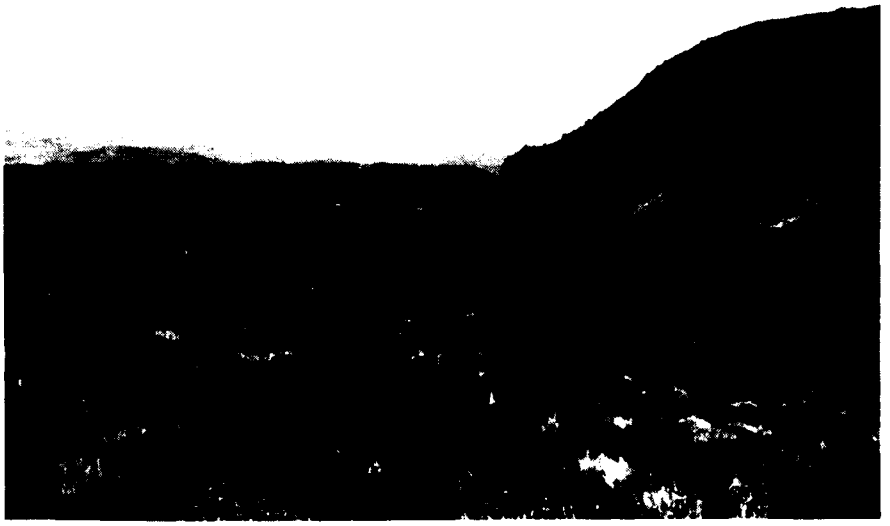


FIGURE 7.6-2 Southernmost end of Wild Horse Mesa, east of Volcano Butte (view looking south).

LIVING STEMS		CARCASSES	
HEIGHT (cm.)	% OF TOTAL FOUND	ESTIMATED AGE	% OF TOTAL FOUND
≤2½(seedlings)	47	0-2 yrs	45
>2½-5	10		
>5-7½	19	2-4 yrs	22
>7½-10	24		
>10-12½	0		
>12½-15	0	4+ yrs	33
>15	0		

Carcasses/Stem Ratio: .42

≤ = LESS THAN OR EQUAL TO
> = GREATER THAN

TABLE 7.6-1 Size classifications of stems and age classifications of carcasses as a percentage of the total stems/carcasses found, S. Wild Horse Mesa.

SUMMARY DATA SHEET

SOUTH WILD HORSE MESA

DATE OF SURVEY: 12, 13 May 1982

LOCATION: Lower Renegade Canyon, South Wild Horse Mesa, near Little Petroglyph area.

T22S, R40E, sec.36, E ½ sec.35 (Coso Quad.)
T22S, R41E, S ½ sec. 31
T23S, R41E, N ½ sec.6 (Mtn. Spgs. Quad.)

PREVIOUS SITINGS:

T22S, R40E, sec.36 (Mary Ann Henry, China Lake, Ca., 1982)

T22S, R40E, NE ¼ sec.35, SE ¼ sec.26 (unidentified NWC source)

HABITAT DESCRIPTION: Grassy mesa with basaltic rock outcroppings; several deep, narrow washes cut through the area.

ASPECT: South and west

SLOPE: Slight-moderate. 30^{o} max.

TOPO POSITION: Mid-upper slopes of outcroppings, occasionally on mesa flats.

ELEVATION: 1460-1550 m. (4800-5100 ft.)

PLANT COMMUNITY: Atriplex canescens, Coleogyne ramosissima, Hymenoclea salsola, Lycium Andersonii, Haplopappus Cooperi, Haplopappus linearifolius, Lycium Cooperi, Ephedra nevadensis, Grayia spinosa

GEOLOGICAL SETTING & SOILS: Basaltic rocks of Quaternary age. Soils light in color, rocky; pH = 8.1 (one sample).

DENSITY/AREA: Less than 1 per ha. Population covers approx. 3 km^2.

STEM COUNT: 21 **CARCASS COUNT:** 9 **TOTAL ESTIMATED:** 75

AGE CLASSIFICATIONS: Stems small, less than 12 cm., older specimens not found. Several seedlings found under carcasses.

PHENOLOGY: In fruit (not ripe)
(estimated peak blooming: mid-May)

THREATS

NATURAL: Feral burro grazing and moderate to severe infestation

MAN: None observed

REMARKS: This population may extend further south, particularly in section 6; probably extends up canyon into section 26. Population appears to be in a tenuous state of existence due to infestation and feral burro grazing.

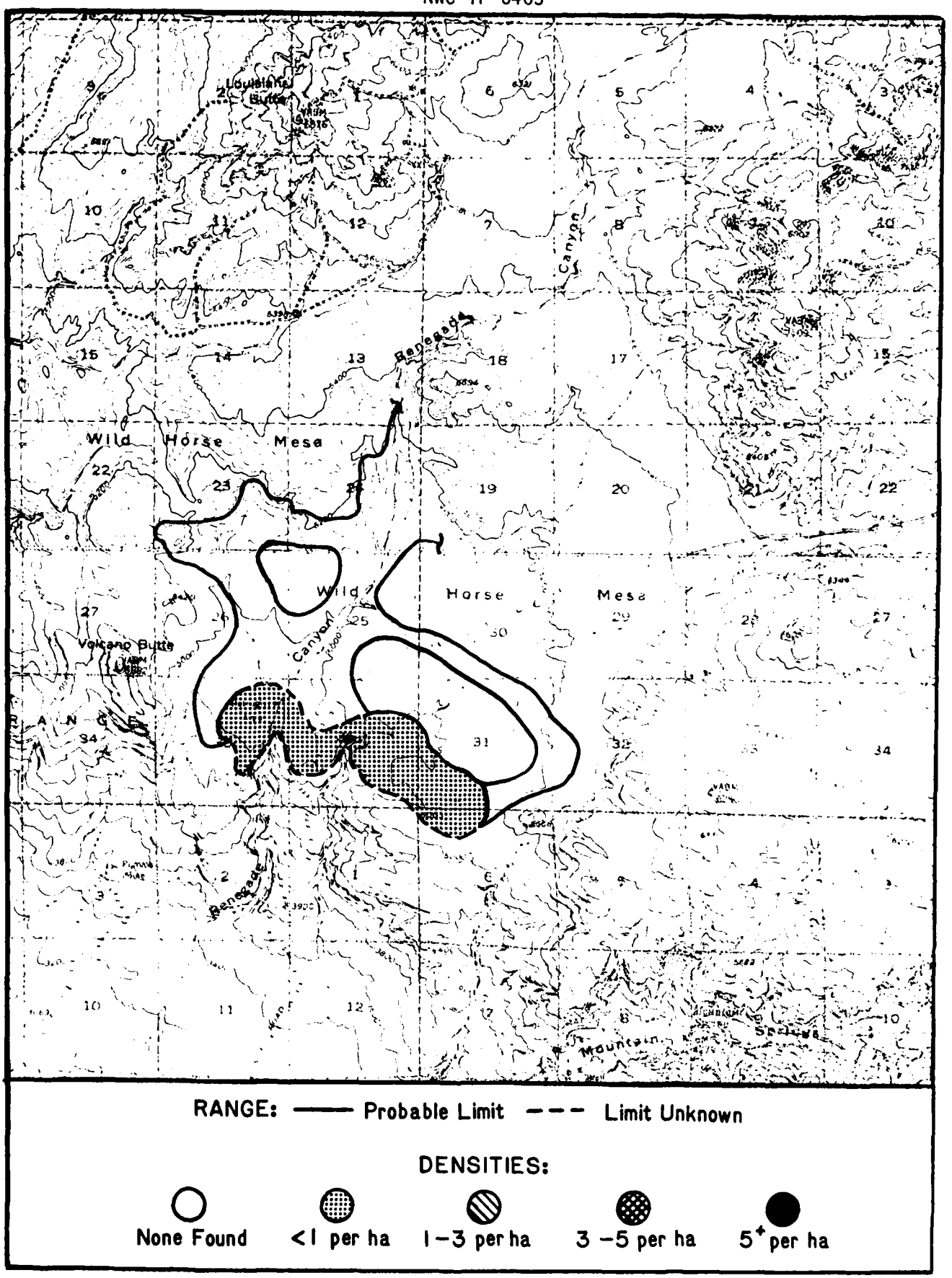


FIGURE 7.6-3 Estimated population densities and range, South Wild Horse Mesa area.

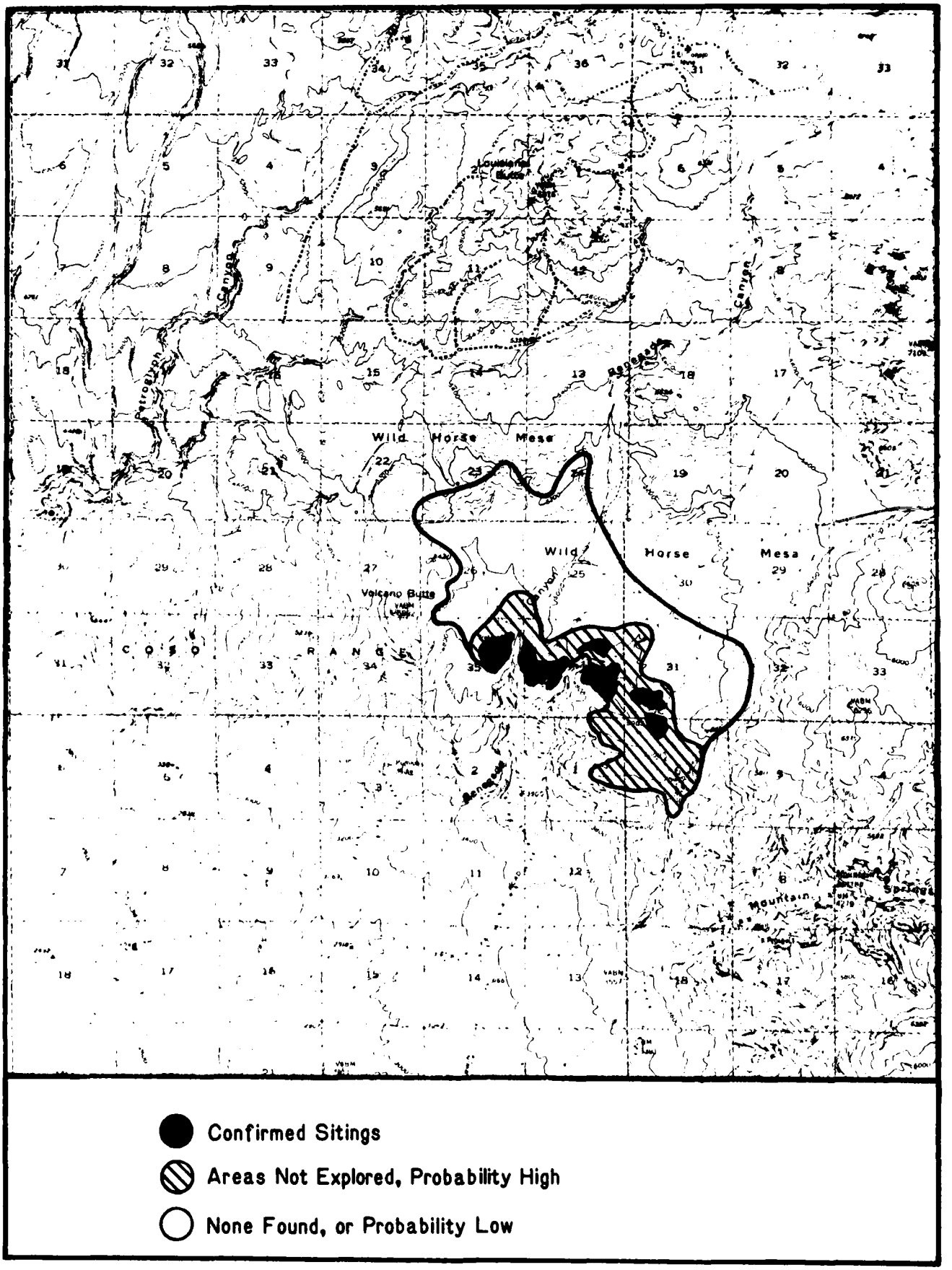


FIGURE 7.6-4 Potential range of Scpo in the South Wild Horse Mesa area based on geological/physiographical setting and visual observations.

7.7 Carricut Lake

General Description:

This population was first noted by DeDecker (1980).

Carricut Lake (usually dry) is located on the south end of Etcheron Valley in the Junction Ranch area. S. polyancistrus was found on the low granitic hills located south and southwest of the lake. Soils are rocky, light in color, and primarily derived from granite parent material. The plant communities on both sides of the valley are similar and dominated by Coleogyne, Grayia, and Artemisia.

Most of the Sclerocacti on the east end of the valley are found on the west slopes of a string of hills, about 1½ km. south of the lake. As one heads east and south toward Water Canyon, the frequency of this species drops off. None were found in the uppermost wash areas of Water Canyon. The southern most limit of Scpo in this area appears to be the northern ½ of sections 29 and 30.

On the west side of the valley, this plant is scattered throughout the low hills both north and south of the road which leads to the Little Petroglyph area. One large specimen was found on the very gentle (almost flat) upslope west of the road in section 24. Soils in the flat west of the road are more porous and, therefore, more likely to support this species than the soils east of the road. The southern limit on the west side of the valley appears to be sections 25 and 26.

Population densities are generally quite low (less than 1/ha). Much of the soils and flora, primarily on the east side of the valley, have been severely damaged by feral burro grazing. Moderate to severe infestation was noted. Most of the stems were less than 15 cm. tall and, at the time (16 March), in their winter growth period. During the 31 May visit, the plants were in late bloom.

Coso/Mtn. Spgs./Maturango Pk./Trona Quadrangle Map: T22S, R41E

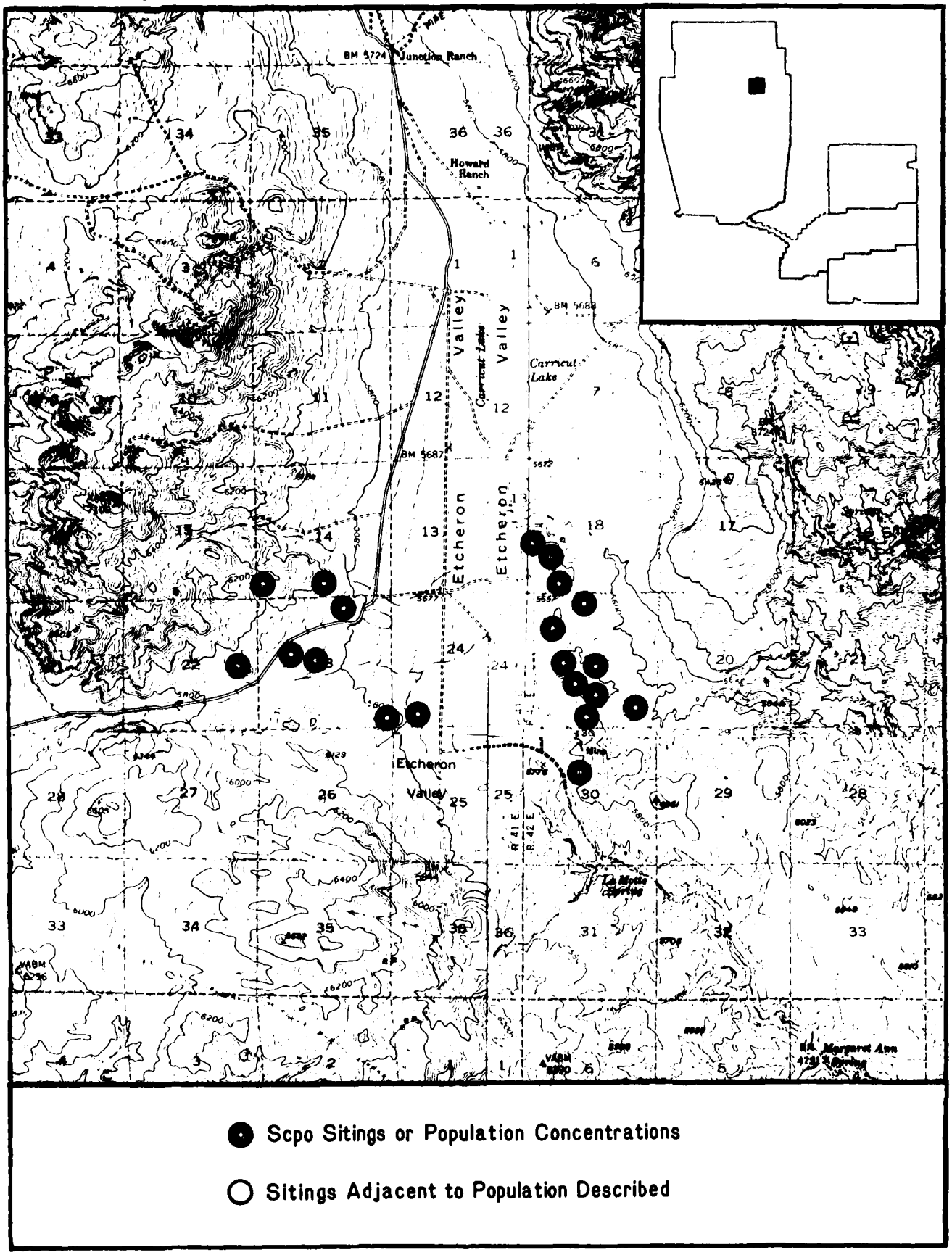


FIGURE 7.7-1 Scpo sitings and population concentrations in the Carricut Lake area.

FIGURE 7.7-2 Typical habitat along west slopes of hills south of Carricut Lake (view looking southwest).

LIVING STEMS		CARCASSES	
HEIGHT (cm.)	% OF TOTAL FOUND	ESTIMATED AGE	% OF TOTAL FOUND
≤2½ (seedlings)	11	0-2 yrs	34
>2½-5	42		
>5-7½	22	2-4 yrs	33
>7½-10	14		
>10-12½	8		
>12½-15	0	4+ yrs	33
>15	3		

Carcass/Stem Ratio: .58

≤ = LESS THAN OR EQUAL TO
> = GREATER THAN

TABLE 7.7-1 Size classifications of stems and age classifications of carcasses as a percentage of the total stems/carcasses found, Carricut Lake area.

SUMMARY DATA SHEET

CARRICUT LAKE

DATE OF SURVEY: 15, 16 March; 31 May 1982

LOCATION: South end of Etcheron Valley, hills south and southwest of Carricut Lake.

T22S, R41E, sec.22, 23, S ½ sec.14, W ½ sec.24 (Coso Quad.)
T22S, R42E, SW ¼ sec.18, sec.19, N ½ sec.30 (Trona, Maturango Pk. Quad.)

PREVIOUS SITINGS:

"Argus Range, S. of Carricut Lake. 5600 ft." (Mary DeDecker, 1980)

HABITAT DESCRIPTION: Low granitic hills, rocky soils.

ASPECT: South, west and east.

SLOPE: Slight-moderate, 5-45°

TOPO POSITION: Usually lower slopes of hills, occasionally on upper slopes and crest; one found on "flat" west of road.

ELEVATION: 1740-1860 m. (5700-6100 ft.)

PLANT COMMUNITY: Coleogyne ramosissima, Artemisia tridentata, Haplopappus sp., Ephedra viridis, Ephedra nevadensis, Yucca brevifolia, Chrysothamnus teretifolius, Grayia spinosa

GEOLOGICAL SETTING & SOILS: Mesozoic granite. Soils are rocky and light-colored; pH = 8.0 (one sample).

DENSITY/AREA: Generally less than 1/ha; population covers about 5 km^2.

STEM COUNT: 36 **CARCASS COUNT:** 21 **TOTAL ESTIMATED:** 100

AGE CLASSIFICATIONS: Most stems small, usually less than 15 cm.(probably less than 10 years old). Seedlings present under carcasses.

PHENOLOGY: East side of valley (15 March) in winter growth period.
West side of valley (31 May) in late bloom.

THREATS

NATURAL: Damage from feral burro grazing likely; infestation moderate-severe

MAN: None observed

REMARKS: Feral burro grazing noted, especially on east side of valley. Several stems were found which appeared to be under stress.

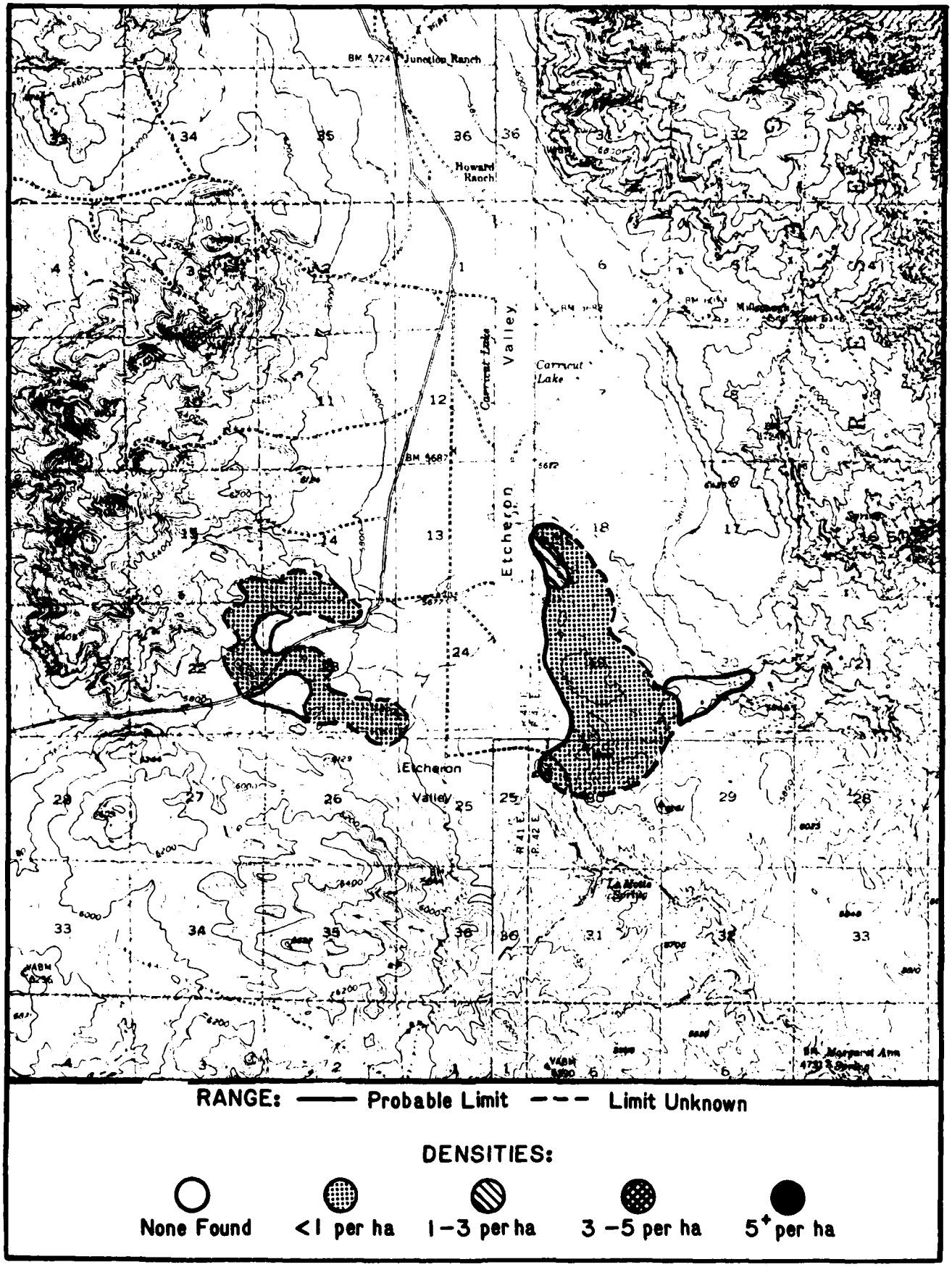


FIGURE 7.7-3 Estimated population densities and range, Carricut Lake area.

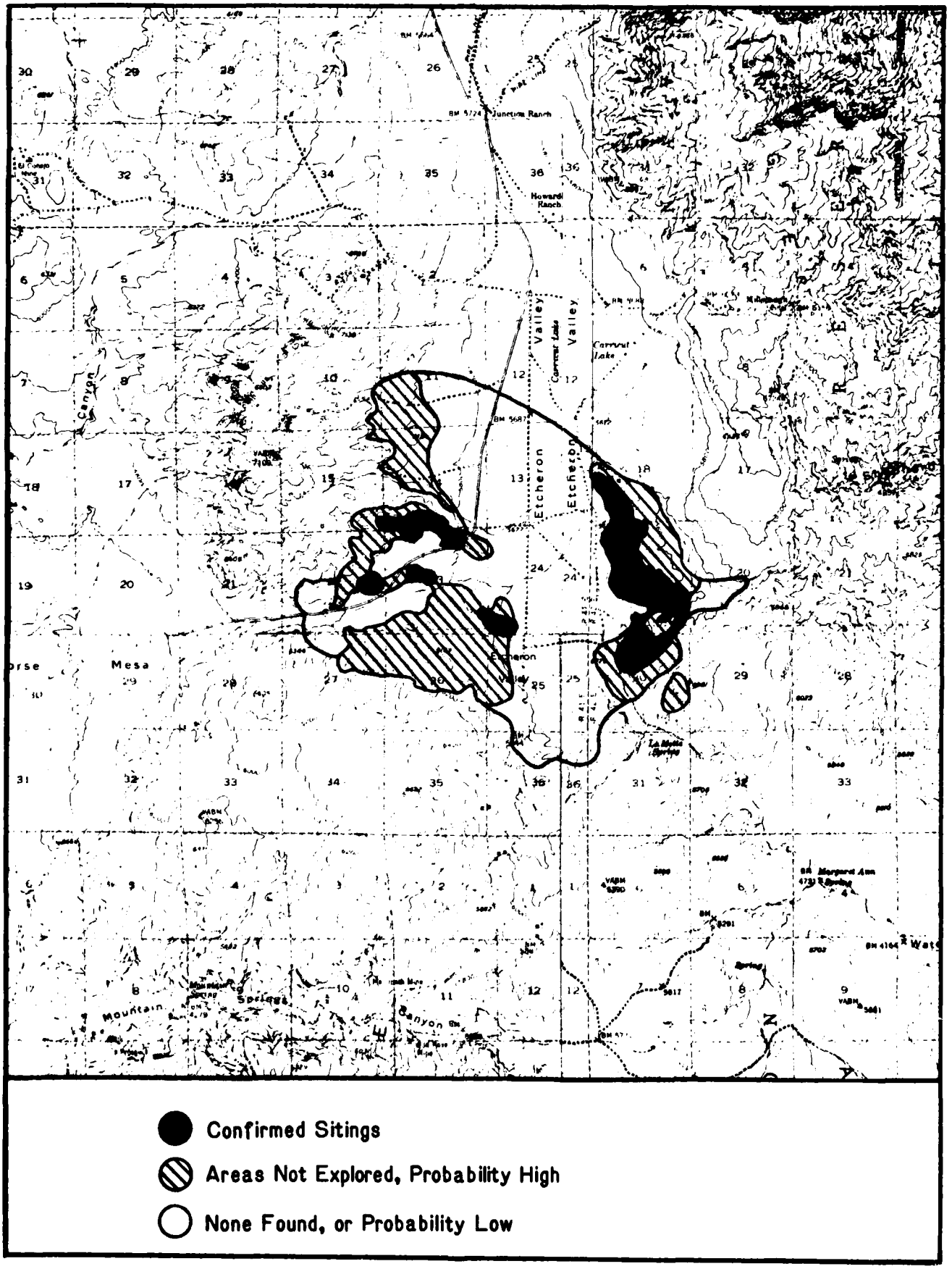


FIGURE 7.7-4 Potential range of Scpo in the Carricut Lake area based on geographical/physiographical setting and visual observations.

7.8 Granite Wells

General Description:

The original 1922 siting by I.M. Johnston has caused some confusion relative to location since there are at least two "Granite Well(s)" in San Bernardino County. However, given the proximity of the Granite Wells near Pilot Knot to the 1891 "Copper City Spgs." siting by Covile & Funston and the uniformity of the geological setting, it was without surprise that Scpo was, in fact, found at this location during this survey, thereby confirming the original siting.

This population is actually a portion of one, almost continuous distribution of S. polyancistrus in this region. The area is predominantly granite, and soils are porous and rocky. The dominant shrubs are Larrea, Grayia, Coleogyne, Lycium, Chrysothamnus, and Ephedra. Three other sensitive plant species are also found in this area (see Section 9.0).

Scpo was found to be thinly distributed throughout the west slopes of Pilot Knob. Several colonies were also found in the hills west of the road northwest of Granite Wells (sections 11, 10, & 15). Here, the land begins to descend into Pilot Knob Valley and the aspect is generally north. The northern limit of this species range in this area appears to coincide with the 1036 m. (3400 ft.) elevation contour.

The survey of this population was conducted in January. The stems were small (generally less tnan 10 cm.) and difficult to spot. This probably accounts for the low stem count. Irrespective of this fact, it does not appear that densities are very high at this location. Small mammal predation was intense, particularly in the bills southwest of Pilot Knob in sections 26 and 27.

It is very likely this population extends further to the northwest encompassing most of the hills within the northwest ¼ of T29S, R44E. The east slopes of Pilot Knob should also be suspect, particularly sections 24, 25, and the northwest ¼ of section 30 (T29S, R45E).

It is recommended that at least a portion of this general region be considered as a candidate for a NWC refuge for this species (see Section 9.0). This area represents an excellent field laboratory for the study of small mammal predation on S. polyancistrus.

Pilot Knob Quadrangle Map: T29S, R44E

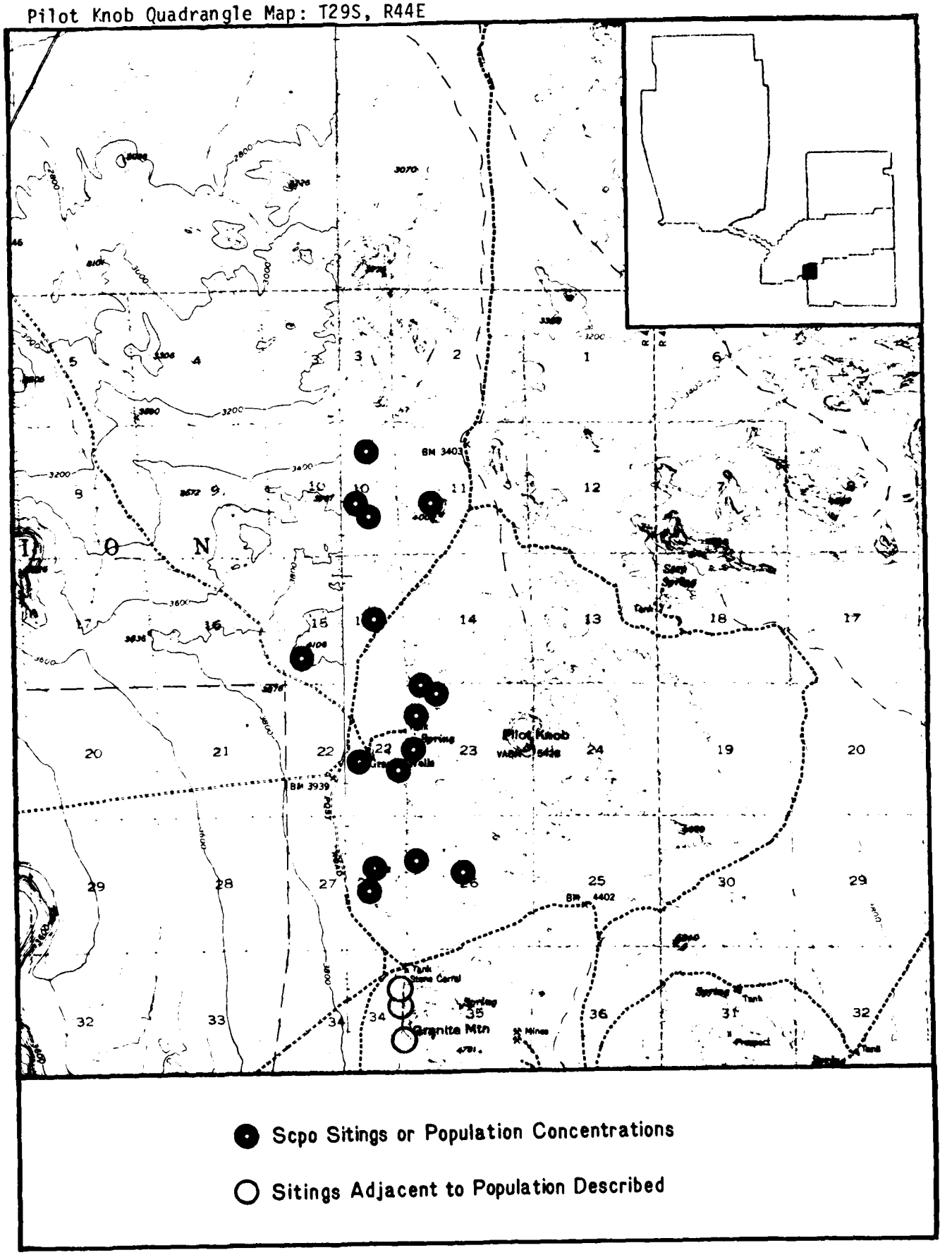


FIGURE 7.8-1 Scpo sitings and population concentrations, Granite Wells area.

FIGURE 7.8-2 Hills north of Granite Wells where several colonies of Scpo were found (view looking northwest).

LIVING STEMS		CARCASSES	
HEIGHT (cm.)	% OF TOTAL FOUND	ESTIMATED AGE	% OF TOTAL FOUND
≤2½(seedlings)	12	0-2 yrs	23
>2½-5	19		
>5-7½	38	2-4 yrs	46
>7½-10	19		
>10-12½	6		
>12½-15	6	4+ yrs	31
>15	0		

Carcass/Stem Ratio: .81

≤ = LESS THAN OR EQUAL TO
> = GREATER THAN

TABLE 7.8-1 Size classifications of stems and age classifications of carcasses as a percentage of the total stems/carcasses found, Granite Wells area.

SUMMARY DATA SHEET

GRANITE WELLS

DATE OF SURVEY: 17 Jan. & 13 Mar. 1982

LOCATION: West and southwest of Pilot Knob; hills north of Granite Wells

T29S, R44E, E ½ sec.10, W ½ sec.11, sec. 15, E ½ sec.22, sec.26 W ½ sec.23, E ½ sec.27 (Pilot Knob Quad.)

PREVIOUS SITINGS:

"San Bernardino County, Granite Well, Mojave Desert." I.M. Johnston, May 15, 1922 5605, POM, DS.

HABITAT DESCRIPTION: Low, rocky granitic hills. Soils porous.

ASPECT: West, north, and south

SLOPE: Slight-moderate, 40° max.

TOPO POSITION: Lower and mid slopes, occasionally on crest of low hills

ELEVATION: 1100-1280 m. (3600-4200 ft.)

PLANT COMMUNITY: Larrea divaricata, Grayia spinosa, Coleogyne ramosissima, Chrysothamnus teretifolious, Hymenoclea salsola, Ephedra nevadensis, Ambrosia dumosa, Yucca brevifolia, Lycium sp., Haplopappus Cooperi, Eriogonum inflatum, Eriogonum fasciculatum

GEOLOGICAL SETTING & SOILS: Mesozoic granite. Soils porous and rich in granitic detritus; pH = 7.2 (one sample).

DENSITY/AREA: Generally less than 1 per ha covering approx. 8 km^2.

STEM COUNT: 16 **CARCASS COUNT:** 13 **TOTAL ESTIMATED:** 100

AGE CLASSIFICATIONS: Stems small, most less than 10 cm.; seedlings present.

PHENOLOGY: Early growth period. Estimated peak blooming period: mid-May.

THREATS

NATURAL: Moderate-severe small mammal predation

MAN: None observed

REMARKS: This population probably extends further northwest into sections 4, 5, 9, 8, and 16; also likely east of Pilot Knob.

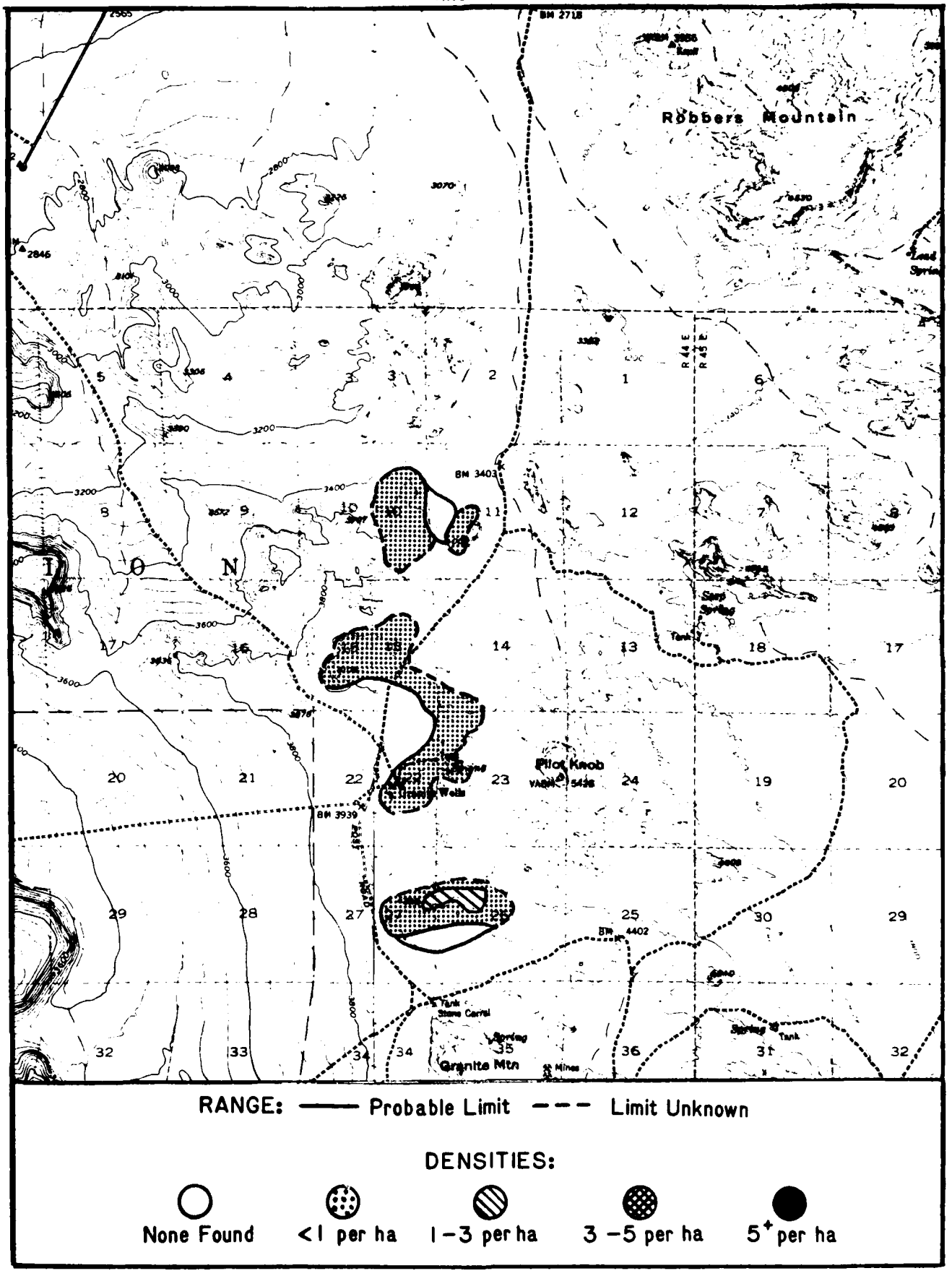


FIGURE 7.8-3 Estimated population densities and range, Granite Wells area.

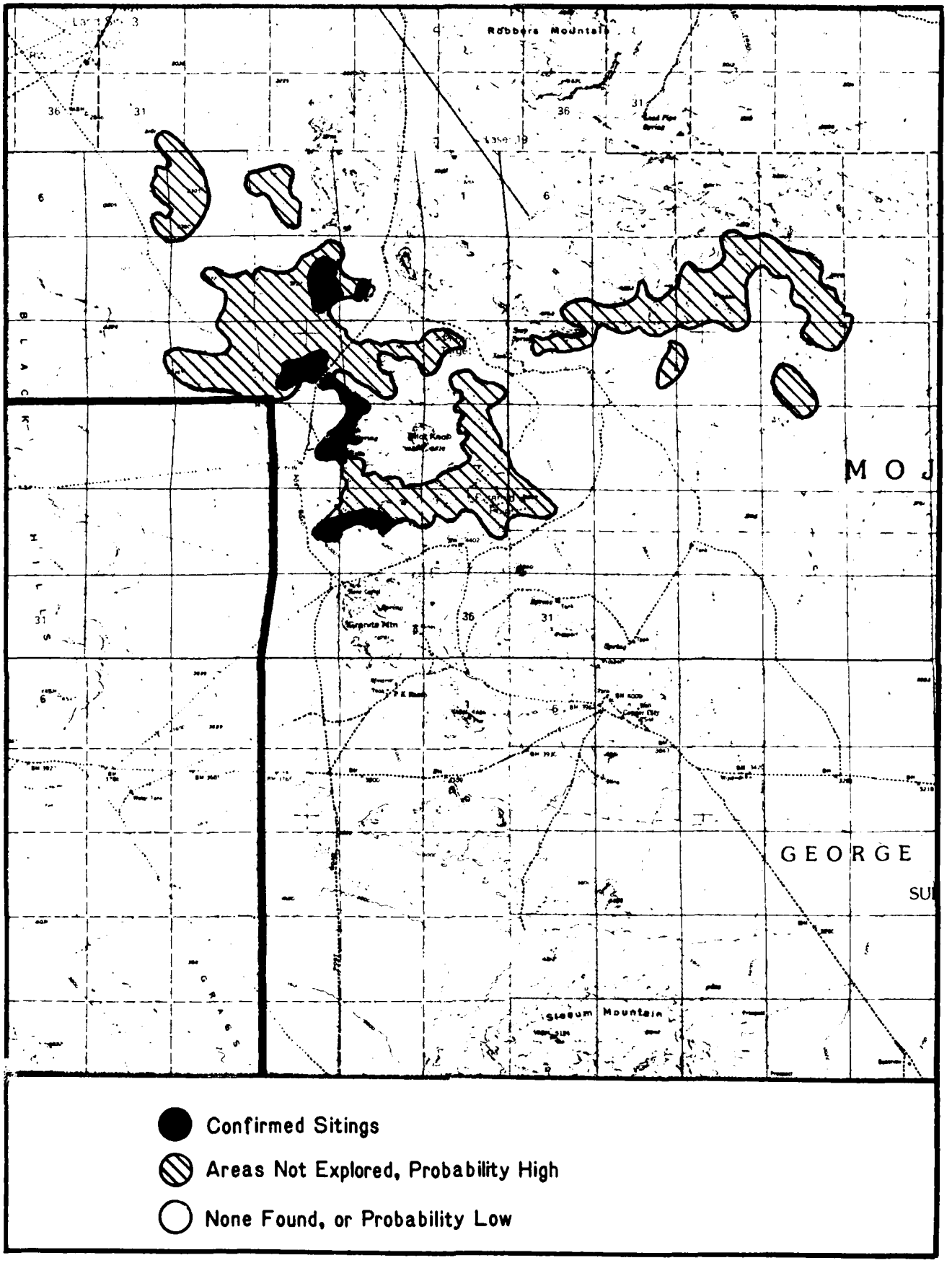


FIGURE 7.8-4 Potential range of Scpo in the Granite Wells area based on geological/physiographical setting and visual observations.

7.9 Granite Mountain

General Description:

This population is centered around a prominent, appropriately named mountain, just south of Pilot Knob. The habitat is similar to that of the Granite Wells and Copper City populations described in Sections 7.8 and 7.10. Soils are rocky and porous, particularly along the west slopes of Granite Mtn.. Scpo was found thinly distributed over the west and south lower slopes in association with Larrea, Grayia, Hymenoclea, Ephedra, Lycium, Chrysothamnus, and Haplopappus.

To the south, a five-stem cluster was found on the west slope of the 1295 m. (4246 ft.) dome.

The low population densities of S. polyancistrus in this area are probably attributable to the intense small mammal predation present here. Three notable concentrations were found, however: one at the mid-way point along the west slope of Granite Mtn. and two others just north and northwest of the site of P.K. Ranch. The size of the stems was relatively small, usually less than 15 cm. and, again, due chiefly to predation. The plants were robust and in their winter growth period.

Future surveys in this region should be directed toward the hills south of Granite Mountain and the west slopes of Slocum Mountain.

It is recommended that this general region be considered as a candidate for a NWC refuge for this species (see Section 9.0).

Pilot Knob Quadrangle Map: T30S, R44E

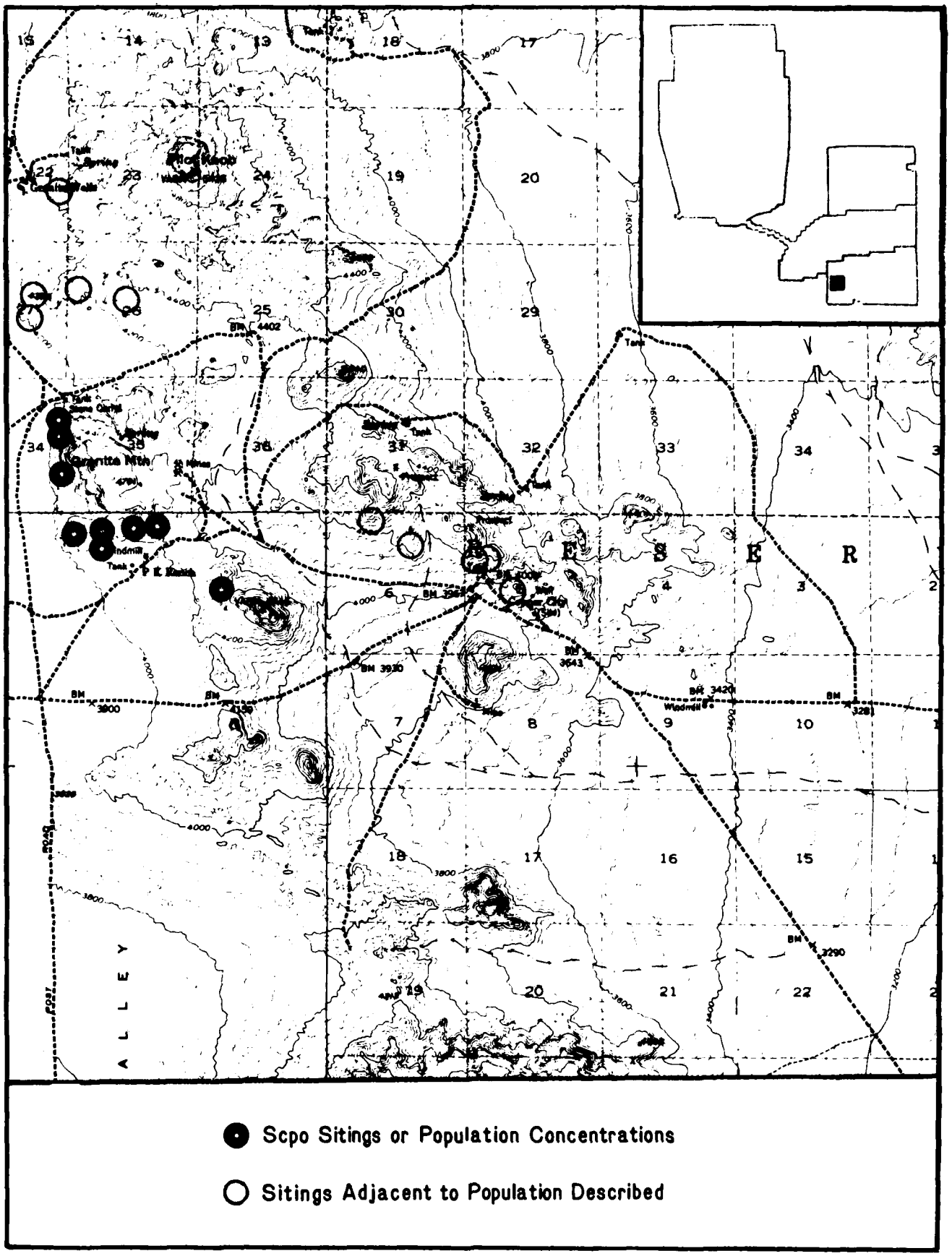


FIGURE 7.9-1 Scpo concentrations and population concentrations, Granite Mtn. area.

FIGURE 7.9-2 Habitat near P.K. Ranch, south slopes of Granite Mtn..

LIVING STEMS		CARCASSES	
HEIGHT (cm.)	% OF TOTAL FOUND	ESTIMATED AGE	% OF TOTAL FOUND
≤2½(seedlings)	32	0-2 yrs	20
>2½-5	32		
>5-7½	16	2-4 yrs	40
>7½-10	12		
>10-12½	0		
>12½-15	4	4⁺ yrs	40
>15	4		

Carcass/Stem Ratio: .40

≤ = LESS THAN OR EQUAL TO
> = GREATER THAN

TABLE 7.9-1 Size classifications of stems and age classifications of carcasses as a percentage of the total stems/carcasses found, Granite Mtn. area.

SUMMARY DATA SHEET

GRANITE MOUNTAIN

DATE OF SURVEY: 16, 17 January 1982

LOCATION: 3 km.(2 miles) south of Pilot Knob at Granite Mtn.

T29S, R44E, E ½ sec.34, W ½ sec. 35 (Pilot Knob Quad.)
T30S, R44E, sec.2, W ½ sec.1

PREVIOUS SITINGS:

"P.K. Ranch area" (Tom McGill, NWC, 1981)

HABITAT DESCRIPTION: Upper bajada, Granite Mtn. and on south slopes of foothills near P.K. Ranch. Granitic outcroppings/alluvium present.

ASPECT: South and west

SLOPE: Slight-moderate, 35^{o}max.

TOPO POSITION: Lower slopes

ELEVATION: 1190-1340 m.(3900-4400 ft.)

PLANT COMMUNITY: Larrea divaricata, Grayia spinosa, Hymenoclea salsola, Ephedra nevadensis, Lycium sp., Tetradymia sp., Chrysothamnus teretifolius, Yucca brevifolia, Haplopappus Cooperi

GEOLOGICAL SETTING & SOILS: Mesozoic granite. Soils porous and rich in granitic detritus; pH = 7.2 (one sample).

DENSITY/AREA: Generally less than 1/ha. Covers 3 km^2.

STEM COUNT: 25 **CARCASS COUNT:** 10 **TOTAL ESTIMATED:** 100

AGE CLASSIFICATIONS: Stems generally small (probably less than 10 years old). Seedlings present.

PHENOLOGY: Early winter growth period. Estimated peak blooming: Mid-May.

THREATS

NATURAL: Moderate small mammal predation

MAN: None observed

REMARKS: This population probably extends much further south. Also likely Scpo exists on lower east slopes of Granite Mtn.(near mine area).

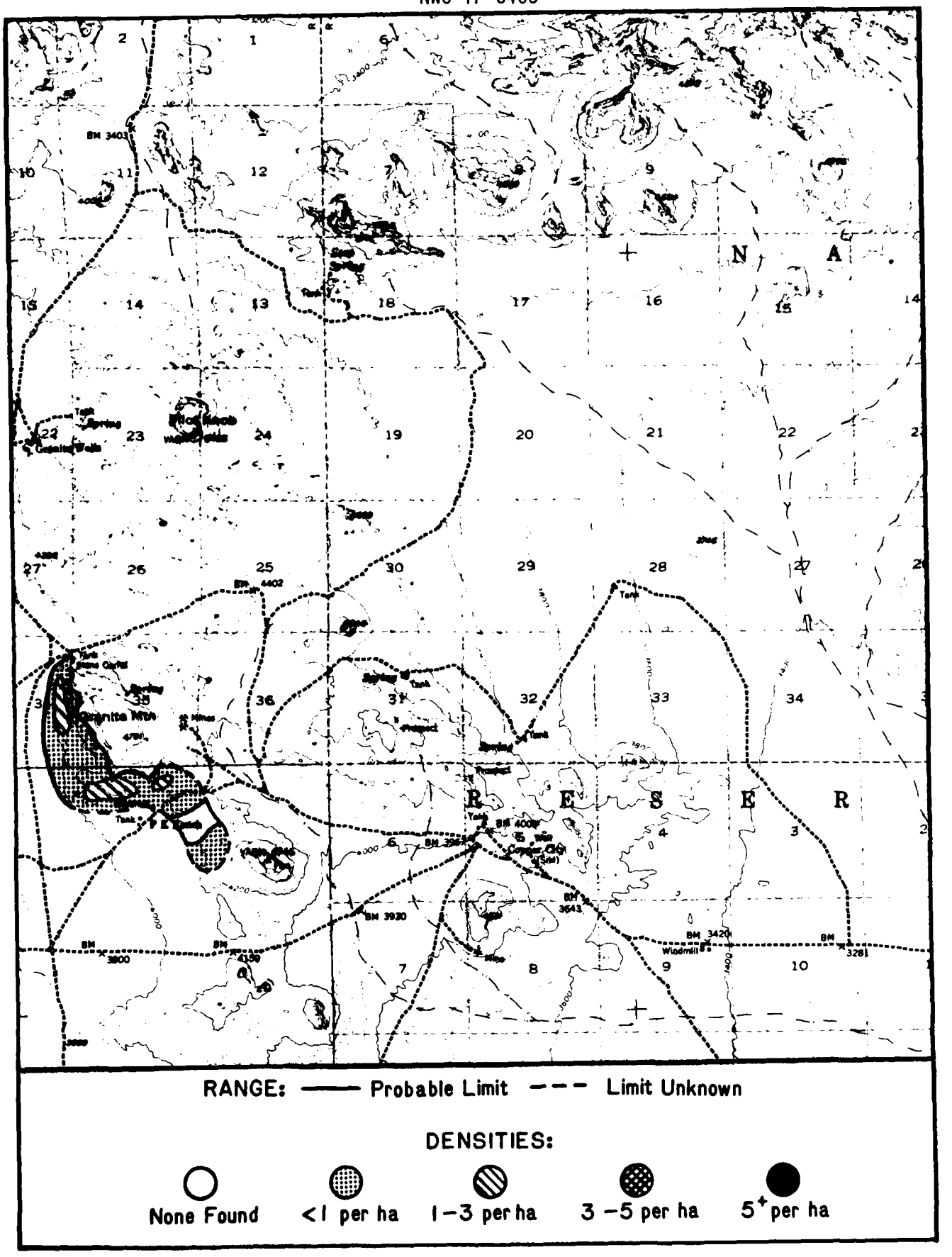


FIGURE 7.9-3 Estimated population densities and range, Granite Mountain area.

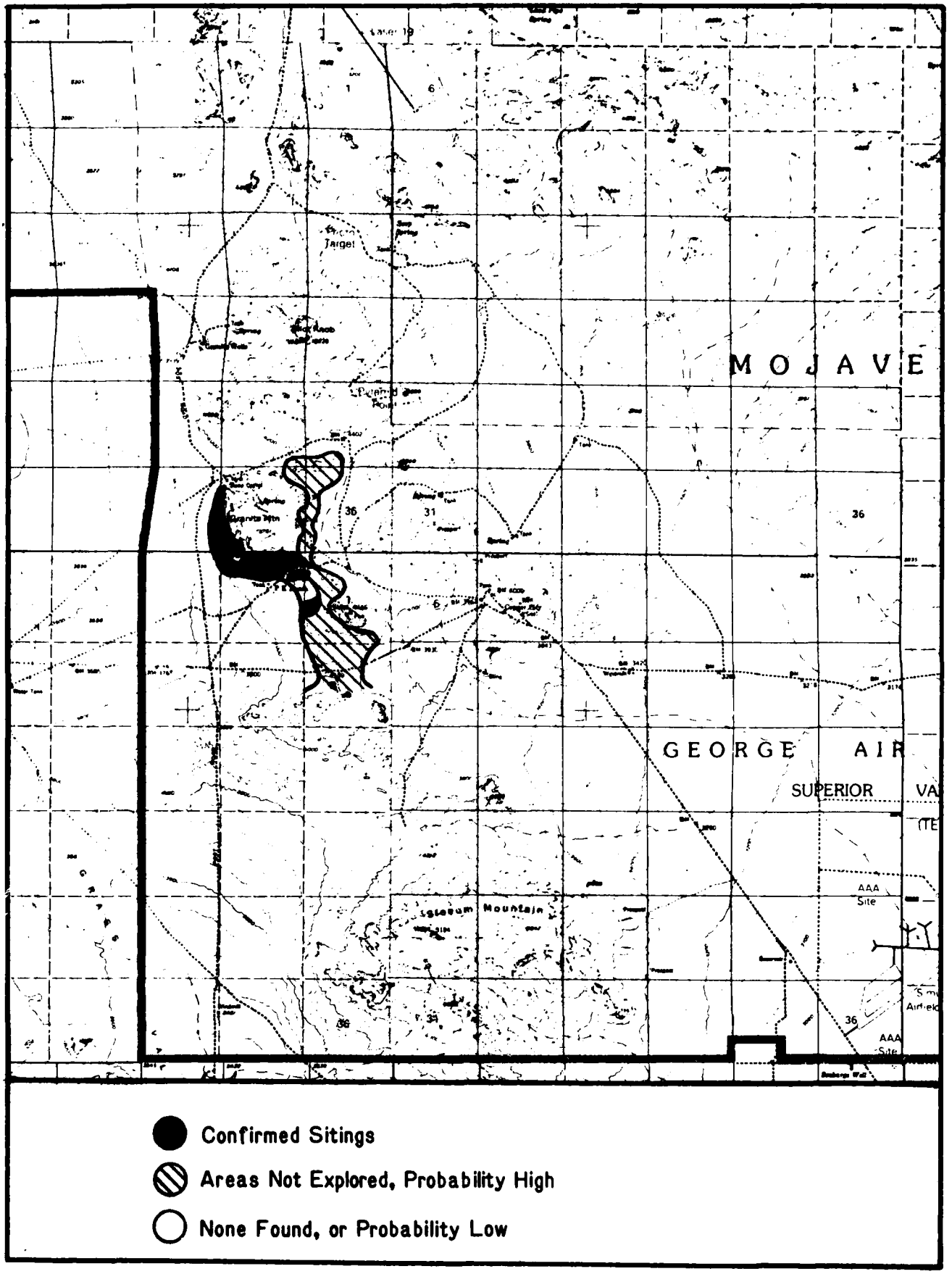


FIGURE 7.9-4 Potential range of Scpo in the Granite Mountain area based on geological/physiographical setting and visual observations.

7.10 Copper City Springs

General Description:

This population was originally reported in 1891 by Coville and Funston and represents the eastern limit of the general distribution of S. polyancistrus in this region.

The habitat in this area is similar to the Granite Wells and Granite Mountain populations described in Sections 7.8 and 7.9 in terms of both flora and soils present. Some dark volcanic rocks (possibly basalts) were noted on the south slopes of a ridge in the northern ½ of section 4 where several Sclerocacti were found. In the remainder of this area, granite is the dominant rock. Aside from the absence of Coleogyne and the appearance of Ambrosia, the shrubs are also similar and consist of Larrea, Lycium, Haplopappus, Ephedra, Hymenoclea, and Grayia.

Scpo densities were generally quite low (less than 1 per ha). The most significant concentration was noted in the northwest ¼ of section 5. The hills northwest of Copper City Spgs. (section 6) were briefly searched; only twc plants were found.

It is likely that other colonies exist within this area and were probably missed. Of particular interest on future surveys in this area should be the south slopes of the dome located in the northwest ¼ of section 8 and the lower slopes of Slocum Mountain to the south. Most of this area is under control of George AFB and future field studies in this area must be coordinated through this military installation.

Pilot Knob Quadrangle Map: T30S, R45E

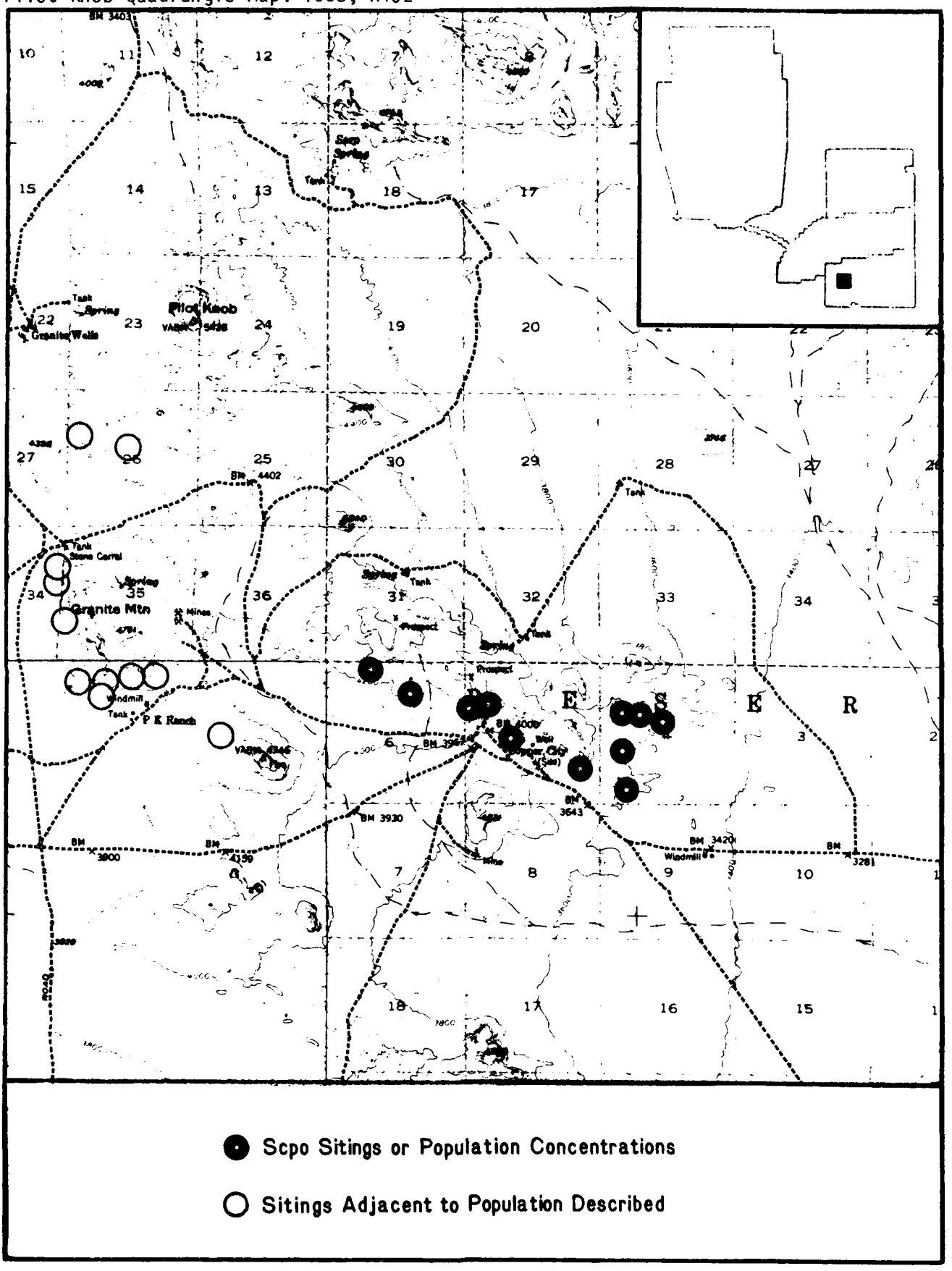


FIGURE 7.10-1 Scpo sitings and population concentrations, Copper City Spgs. area.

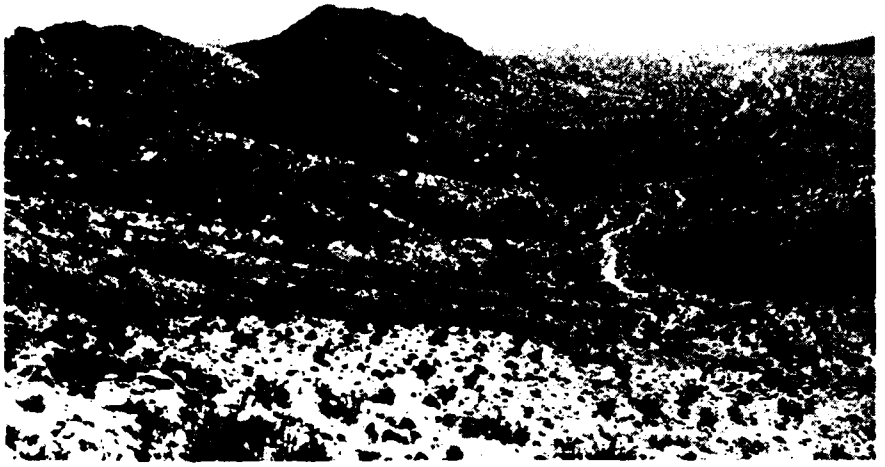


FIGURE 7.10-2 Low hills in the vicinity of Copper City Springs; Superior Valley is in the distance (view looking southeast).

LIVING STEMS		CARCASSES	
HEIGHT (cm.)	% OF TOTAL FOUND	ESTIMATED AGE	% OF TOTAL FOUND
≤2½ (seedlings)	11	0-2 yrs	33
>2½ 5	19		
>5-7½	22	2-4 yrs	45
>7½-10	30		
>10-12½	18		
>12½-15	0	4+ yrs	22
>15	0		

Carcass/Stem Ratio: .33

≤ = LESS THAN OR EQUAL TO
> = GREATER THAN

TABLE 7.10-1 Size classifications of stems and age classifications of carcasses as a percentage of the total stems/carcasses found, Copper City Spgs.

SUMMARY DATA SHEET

COPPER CITY SPGS.

DATE OF SURVEY: 16 January 1982

LOCATION: In the vicinity of Copper City Spgs., about 6½ km. (4 miles) southeast of Pilot Knob.

T30S, R45E, sec. 4, 5, N ½ sec.6 (Pilot Knob Quad.)
T29S, R45E, extreme southern portion of sec.31

PREVIOUS SITINGS:

"Copper City Springs...." Coville & Funston 168, Jan.11, 1891 US(Box)

Note: A previous siting "Crutts Post Office" by I.M. Johnston relates to this general region. The post office was located near Crutts Well.

HABITAT DESCRIPTION: Gentle sloping granitic hills. Several rocky washes.

ASPECT: South and west

SLOPE: Slight to medium, 40° max.

TOPO POSITION: Upper, middle and (predominantly) lower slopes

ELEVATION: 1100-1340 m. (3600-4400 ft.)

PLANT COMMUNITY: Larrea divaricata, Grayia spinosa, Hymenoclea salsola, Lycium Andersonii, Eurotia lanata, Ambrosia dumosa, Tetradymia stenolepis, Ephedra nevadensis, Haplopappus Cooperi, Chrysothamnus teretifolius

GEOLOGICAL SETTING & SOILS: Mesozoic granite. Some dark volcanics noted about 1 km. north of Copper City Spgs. on north side of wash area. Soils rocky and light colored; pH = 7.4 (one sample).

DENSITY/AREA: Generally less than 1/ha; covers about 4 km^2.

STEM COUNT: 27 **CARCASS COUNT:** 9 **TOTAL ESTIMATED:** 150

AGE CLASSIFICATIONS: Old stems absent. Most stems less than 10 cm. tall. Seedlings present.

PHENOLOGY: Early winter growth period.
Estimated peak blooming: early May.

THREATS

NATURAL: Intense small mammal predation

MAN: None observed

REMARKS: Population probably extends north and south of areas surveyed. This population is an excellent field laboratory candidate for the study of small mammal predation on this cactus.

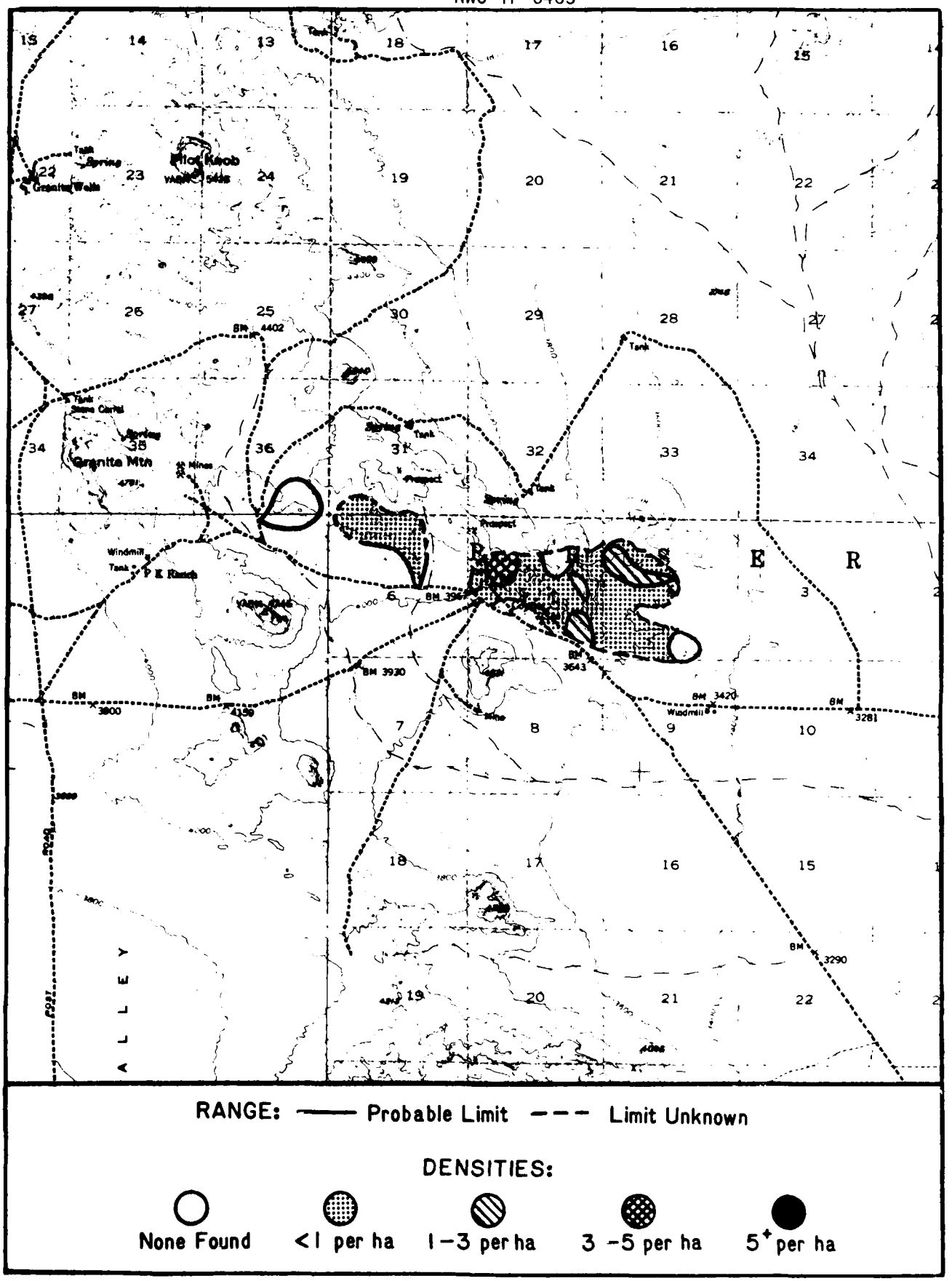
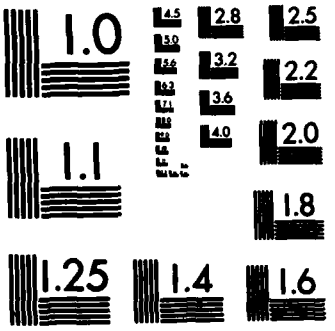


FIGURE 7.10-3 Estimated population densities and range, Copper City Spring

AD-A123 165 DISTRIBUTION AND STATUS OF SCLEROCACTUS POLYANCISTRUS 2/2
ON THE NAVAL WEAPONS CENTER-A SURVEY(U) MAY (RICHARD W)
SEABROOK TX R W MAY OCT 82 NWC-TP-6403
UNCLASSIFIED N62474-81-C-A355 F/G 6/0 NL



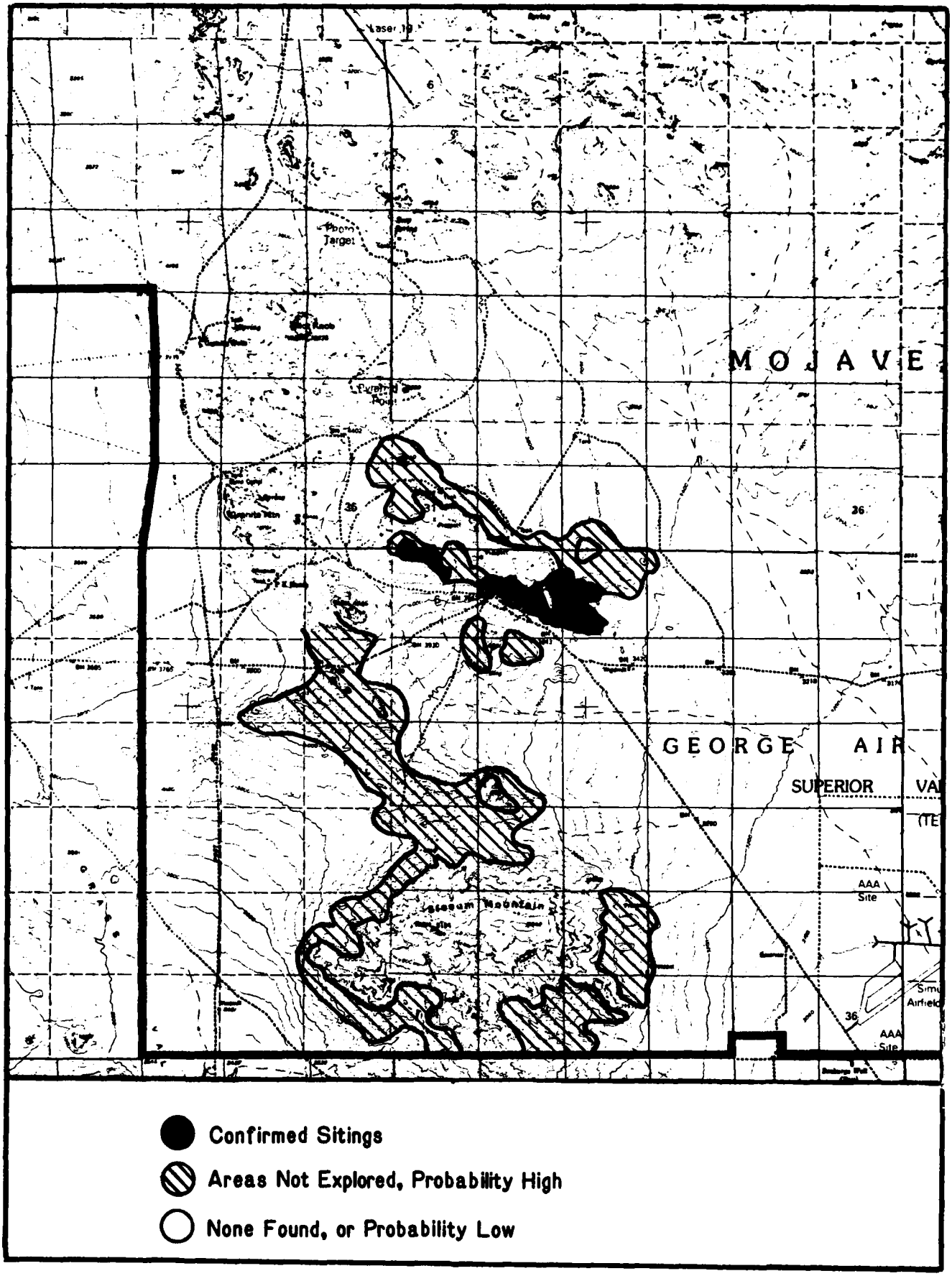


FIGURE 7.10-4 Potential range of Scpo in the Copper City Spgs. area based on geological/physiographical setting and visual observations.

7.11 Indian Springs

General Description:

One small local population was found in the eastern portion of the Mojave B South Range near Indian Springs, just south of the Eagle Crags. In contrast to the predominantly granitic setting along the western boundary of this range, the eastern half is predominantly Tertiary volcanics. The area is extremely rocky. Several large washes transverse the area and numerous volcanic ridges and hills protrude out from the base of the Crags. The survey of this area was brief, but it would appear that Scpo favors the volcanic ridges as opposed to the rocky bajadas. The dominant shrubs include Larrea, Hymenoclea, Lycium, Ephedra, Ambrosia, Haplopappus, and, to a lesser extent, Atriplex.

Densities in this area were found to be very low. Only one plant was found on the rocky bajada just west of the springs. Several large specimens in excess of 30 cm. were noted on the ridge west of the springs in section 4. About 50 meters northwest of the springs, 10 Scpo were found, including 2 seedlings under an open carcass. The plants were in fruit (not ripe).

It was difficult to ascertain the extent of this population. Scpo might be expected to occur further to the northwest, ultimately joining the populations in the Pilot Knob area. It is also possible that a few isolated colonies exist in T30S, R47E. Further field work in this region relative to this species, however, should concentrate on the northern ½ of T29S, R45E.

Pilot Knob Quadrangle Map: T30S, R46E

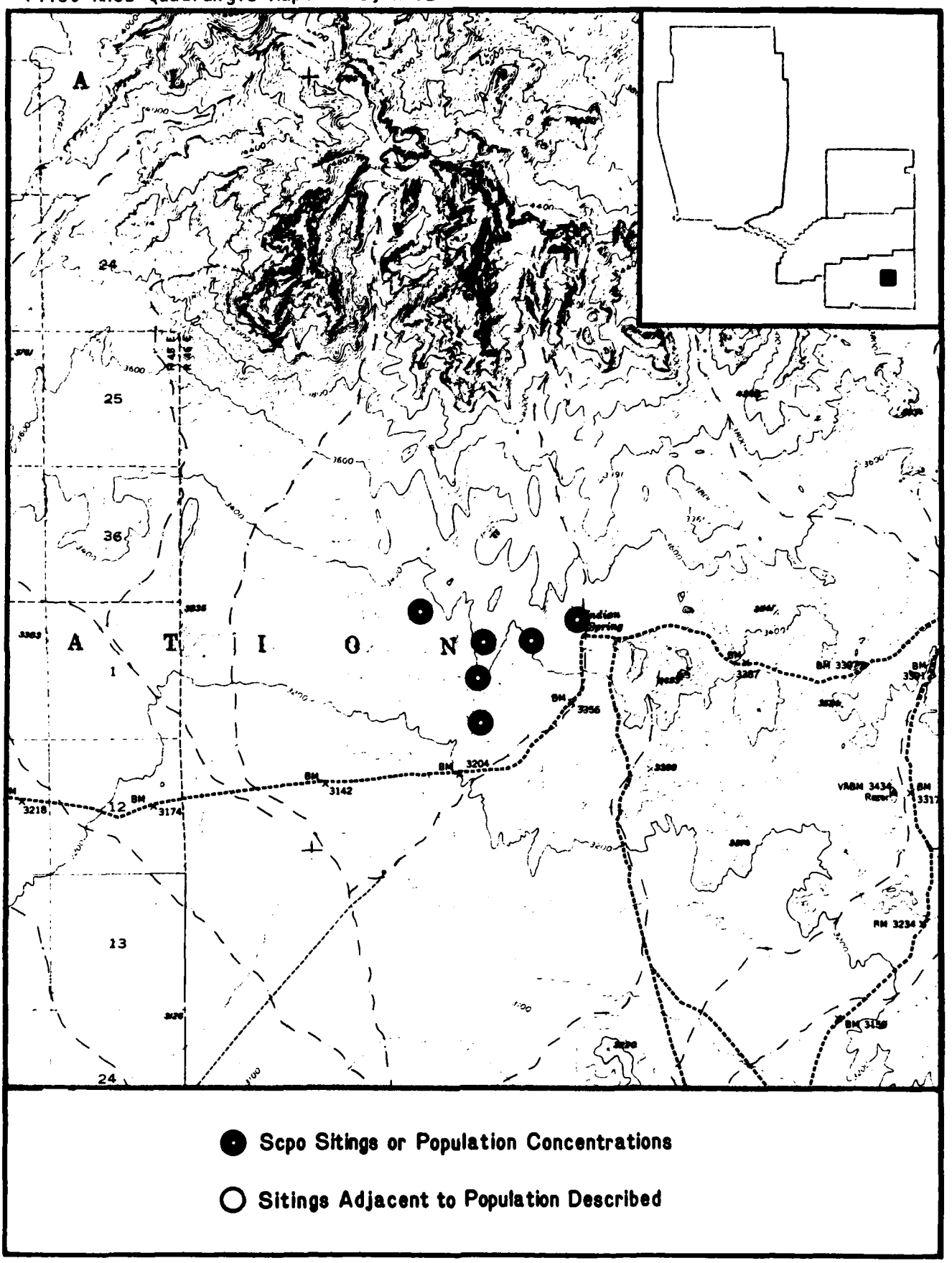


FIGURE 7.11-1 Scpo sitings and population concentrations in the Indian Spgs. area.

FIGURE 7.11-2 Habitat just north of Indian Springs looking north. A large, 30 cm. tall stem can be seen in shrub at extreme lower left corner of photo.

LIVING STEMS		CARCASSES	
HEIGHT (cm.)	% OF TOTAL FOUND	ESTIMATED AGE	% OF TOTAL FOUND
≤2½(seedlings)	16	0-2 yrs	17
>2½-5	0		
>5-7½	16	2-4 yrs	17
>7½-10	21		
>10-12½	16		
>12½-15	5	4^{+} yrs	66
>15	26		

Carcass/Stem Ratio: .32

≤ = LESS THAN OR EQUAL TO
> = GREATER THAN

TABLE 7.11-1 Size classifications of stems and age classifications of carcasses as a percentage of the total stems/carcasses found, Indian Spgs. area.

SUMMARY DATA SHEET

INDIAN SPRINGS

DATE OF SURVEY: 11 June 1982

LOCATION: Indian Springs, south of the Eagle Crags, and in scattered locations to the west.

T29S, R46E, sec.32
T30S, R46E, sec. 4, NE ¼ sec.5 (Pilot Knob Quad.)

PREVIOUS SITINGS:

"Near Indian Springs" (Tom McGill, NWC, 1982)

HABITAT DESCRIPTION: Volcanic ridges and south sloping bajada. Several wide, rocky washes.

ASPECT: South and west

SLOPE: Slight-moderate, 30^{o} max.

TOPO POSITION: Occasionally on bajada; mid-upper slopes of ridges

ELEVATION: 1000-1070 m. (3300-3500 ft.)

PLANT COMMUNITY: Larrea divaricata, Hymenoclea salsola, Ephedra nevadensis, Ambrosia dumosa, Atriplex sp., Lycium sp., Haplopappus Cooperi, Haplopappus linearifolius, Eurotia lanata, Salazaria mexicana

GEOLOGICAL SETTING & SOILS: Tertiary volcanics(tuffs). Rocky, light colored soils; pH = 7.6 (one sample).

DENSITY/AREA: generally less than 1 per ha. Covers approx. 3 km^2.

STEM COUNT: 19 **CARCASS COUNT:** 6 **TOTAL ESTIMATED:** 50

AGE CLASSIFICATIONS: Unusually large number of older stems (over 30 cm.) on ridge west of Indian Springs. Several seedlings found.

PHENOLOGY: In fruit (not ripe). Estimated peak blooming: early May

THREATS

NATURAL: Small mammal predation, intensity indeterminate

MAN: None observed

REMARKS: This population probably extends further to the northwest.

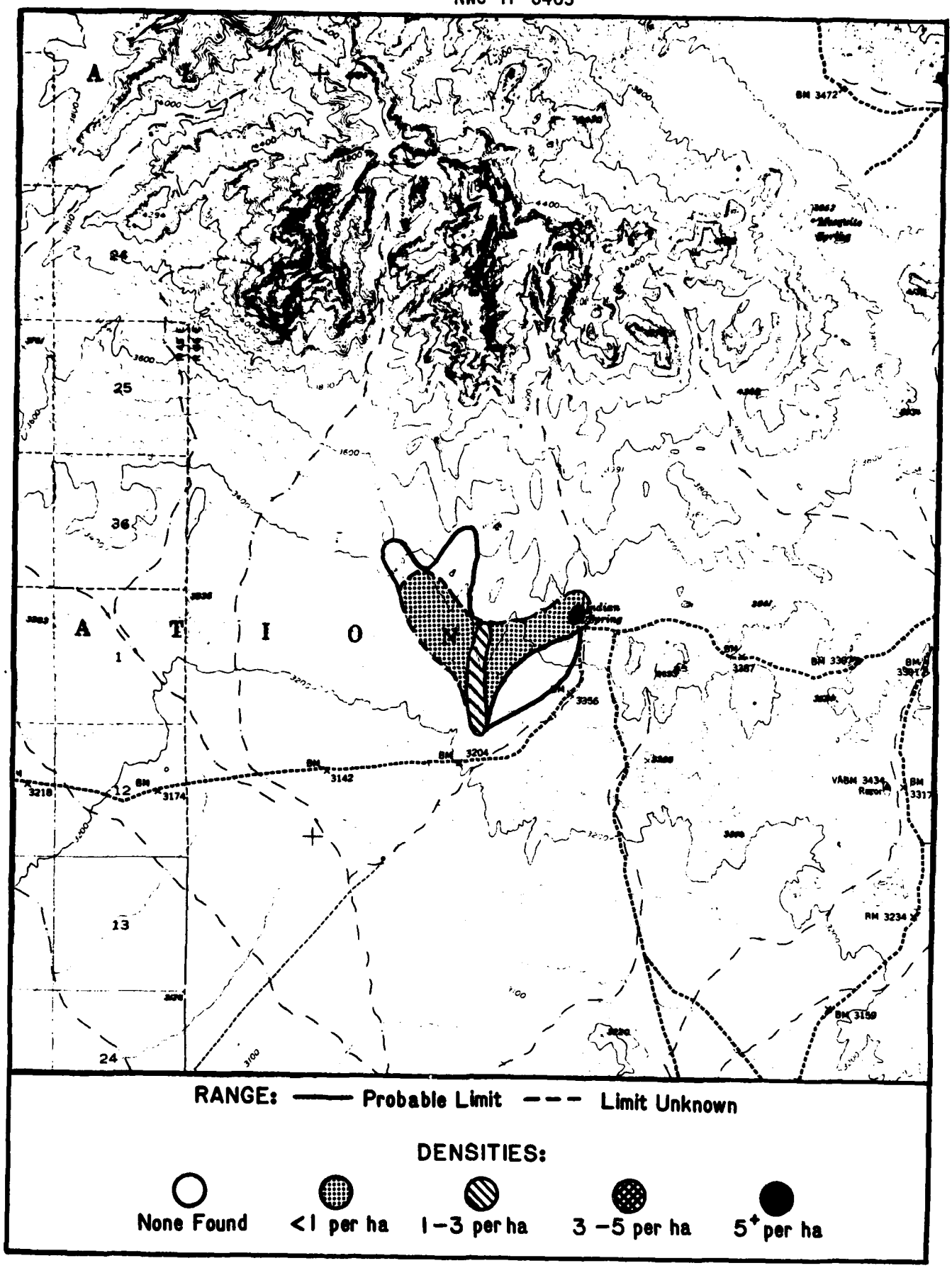


FIGURE 7.11-3 Estimated population densities and range, Indian Spgs. area.

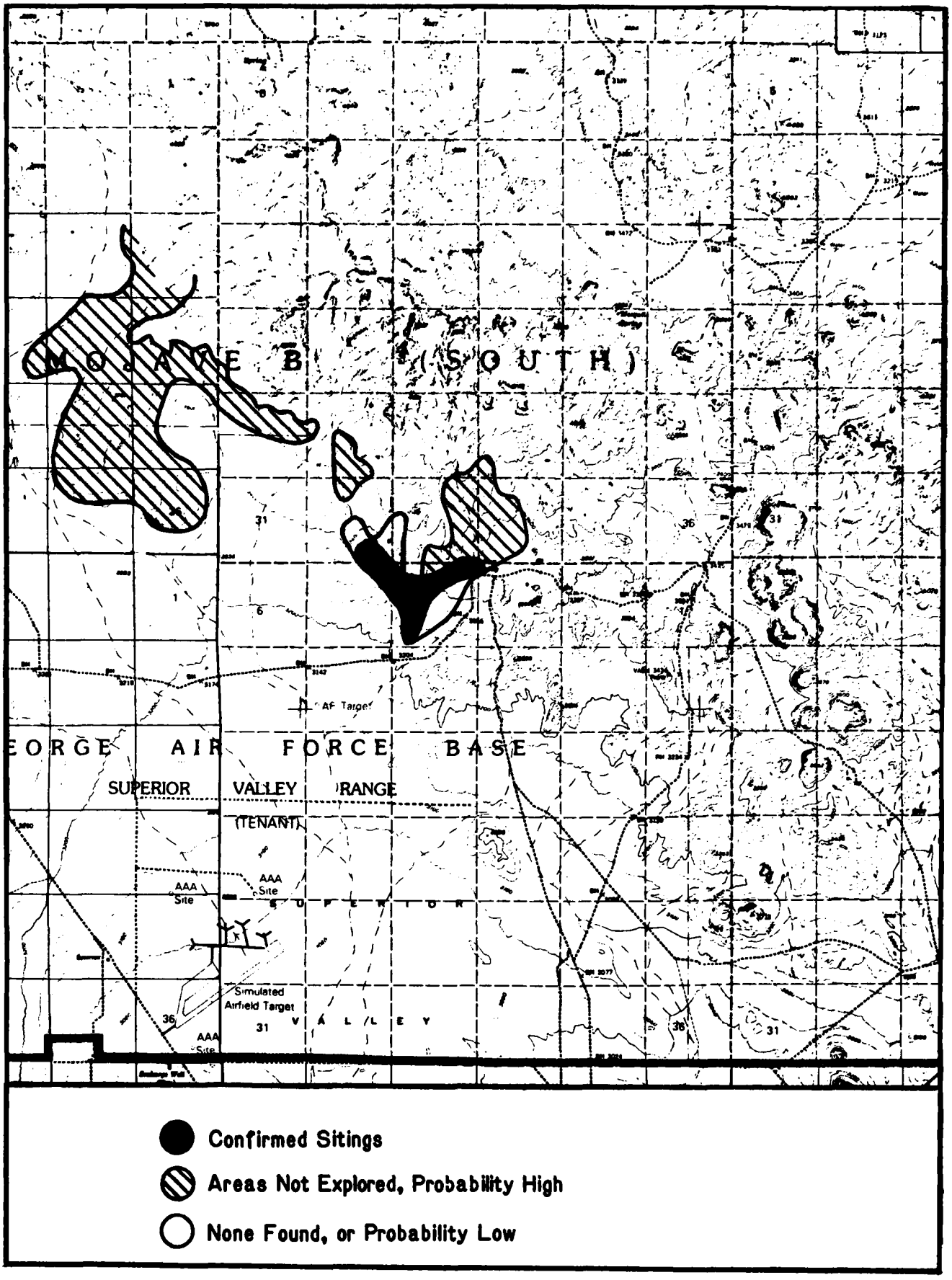


FIGURE 7.11-4 Potential range of Scpo in the Indian Spgs. area based on geological/physiographical setting and visual observations.

8.0 ADDITIONAL SURVEY DATA AND FINDINGS

The following summary provides additional information related to data and findings briefly discussed in Section 7.0.

8.1 Infestation

Survey Findings

Perhaps the most significant piece of data to emerge as a result of this survey was the determination that S. polyancistrus is a host species for the cerambycid beetle Moneilema semipunctatum. This insect is normally associated with the genus Opuntia (Raske, 1966) and, therefore, this finding represents a significant host extension.

Most closed carcasses and damaged stems examined during the course of the NWC survey were found to have similar morphological characteristics. Closed carcasses and damaged stems within populations studied elsewhere in the northern Mojave exhibit similar characteristics (ref. - Section 5.3). Two such specimens were collected and examined and, based on the findings of Doyen (1982) and O'Farrell (1982), it was confirmed that infestation, rather than predation, was the cause of the initial stem damage. The specimen examined by Doyen also contained a pupal cell with a living larva from which the insect identification was made.

According to Doyen (1982) and Raske (1966), the beetles probably oviposit at the base of the stem at the soil line. The larvae then bore into the stem, tunneling up into the cortex from below. Mature larvae form a pupal cell from soil cemented together with secretions. This cell can often be found adjacent the carcass. An adult M. semipuntatum beetle is shown in Figure 8-1.

Once the process has run its course, the remaining stem is probably vulnerable to rot and secondary infestation or predation, contributing to the decline or death of the plant.

In 1980, Larvae from the moth Distopasta yumaelle (Keafott) were found in a stem in the Inyo National Forest (Doyen, 1980). This insect is a scavenger and would normally enter a cactus after damage from another agent, such as would be the case after infestation by Moneilema. Whether this was the case in this instance could not be determined.

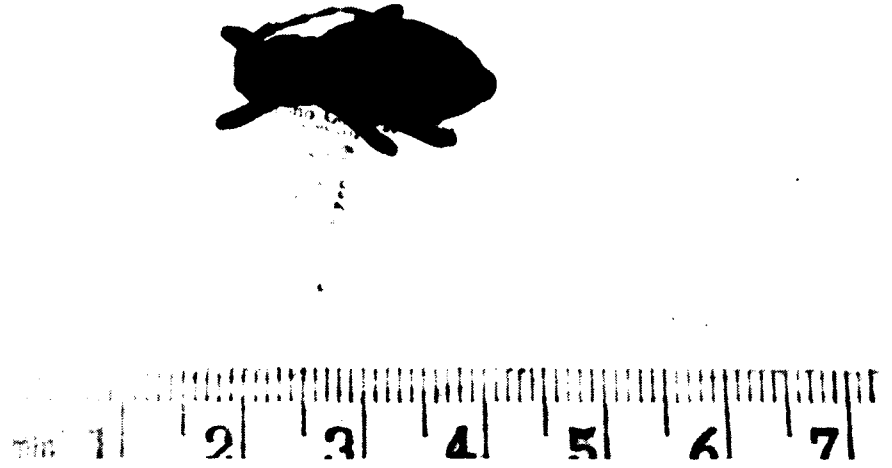


FIGURE 8.1-1 An adult specimen of Moneilema semipunctatum.

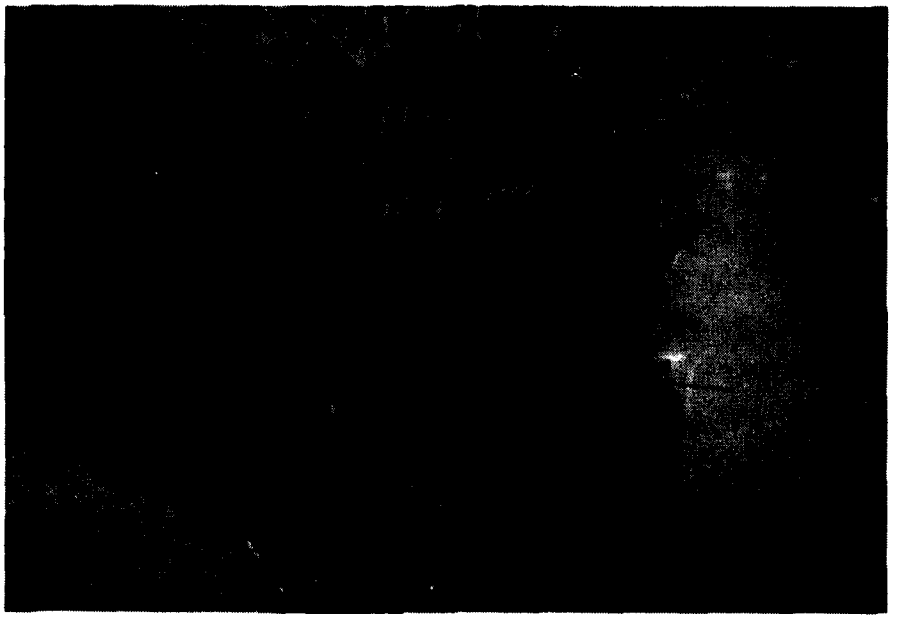


FIGURE 8.1-2 Infested stem with pupal cell collected at Coso Village. Note the entry holes (100-150 mm. in dia.) at the base of the stem.

In many cases, the stem will be completely excised from the root system.[1] If only partial damage has occurred, adventurous roots will emerge at the base of the damaged cortex and occasionally the stem will re-root. There is no data on the percentage of stems which recover. Given the likelihood of rot, however, as well as further infestation or predation, the percentage is probably quite low. In addition, most stems that do recover probably never regain full vitality (MacDougal, et al, 1915).

Field Identification

Future fieldwork on the NWC relative to this species should, whenever possible, include information relating to the presence and number of infested stems and closed carcasses within populations of this cactus. An infested stem, or a stem immediately after infestation will manifest itself in the following manner:

Loss of Vigor - Absence of apical growth reflected in the lack of new spination and buds during the growing season.

Discoloration - Discoloration, usually brown, particularly at the base of the stem.

Apical "Curl-over" - due to internal damage. Top of stem will occasionally bend over and become askew from the original longitudinal axis of the stem (see Figure 5-3). "Pups"(regrowth) can also form in the damaged area.

Cortex Damage - particularly at the base of the stem and/or the presence of one or more entry holes, 50-150 mm. in diameter; one or more "tunnels"(50-150 mm.) progressing upward through the stem.

Excision - Stem excised from the root system.

Pupal Cell(s) - Remnants of pupal cells in the soil adjacent or beneath the stem (Figure 8.1-2).

Closed carcasses resulting from this form of infestation may still exhibit some of the above characteristics depending upon the age of the carcass. Pupal cells and, more often, remnants of channels in the decomposed cortex are still present in one and two year old carcasses.

Caution should be exercised when examining carcasses to ensure seedlings which may be present are not disturbed.

1 It has not yet been determined whether the excised roots are the direct result of the infestation; predation may also be responsible.

Summary

Infestation is a pertinent aspect of this species' ecology. Although it is possible other forms of predation and infestation may be responsible for closed carcasses, it would appear that the majority of these carcasses are the result of infestation by M. semipunctatum.

8.2 Effects of Feral Burro Grazing on S. polyancistrus

Varying degrees of damage to flora and soils on the NWC due to feral burro grazing were observed during the course of this survey. This subject is covered in great depth in the publication by PBR (1981) prepared for the Navy in support of the Feral Burro Management Program. Of obvious concern during this survey were the effects, if any, such damage would have on populations of this cactus.

Two populations were found in areas where heavy grazing from burros had occurred (ref.- Sections 7.6 and 7.7). In both cases it was observed that the apparent effects from burro grazing are similar to those which occur after an incident of livestock (sheep) grazing (see Section 5.4). The following evidence is presented and in the order of greatest significance:

- Damage and, in some cases, the total disappearance of shrubs and perennial grasses were found, leaving a significant percentage of stems and, invariably, seedlings without cover. Several of these stems were observed under stress and sun-reddened, apparently due to sudden and excessive sun exposure.
- Damage to carcasses (overturned or crushed) was found at one location. Carcasses aid in seedling survival.
- The largest (oldest) stems were predominantly situated in protected areas (i.e.-between large rocks or shrubs). It would appear that such stems have achieved greater longevity because of the lesser likelihood of being trampled.
- Burro trails were numerous in both areas. PBR (1981) has noted that soil compaction from such trails can alter the moisture content of the soil and restrict root development. Several stems were found in close proximity to these trails and may be adversely affected by their presence.
- "Burro Wallows" (areas where burros congregate) were noted in several locations. All vegetation in these areas is destroyed.

In addition to above observations, another possible consequence of feral burro grazing was noted. The intensity of infestation due to M. semipunctatum, as evidenced by the ratio of closed carcasses to living stems present, was higher in the two areas where the heavy burro damage was observed. A possible explanation is suggested: resulting reduction of Opuntia basilaris and Opuntia echinocarpa, also due to feral burro grazing, may exert additional infestation pressures on S. polyancistrus. It should be emphasized, however, that insufficient data was collected to lend support to this explanation and it has been presented only as a potential area of study for future fieldwork in this region.

Summary

It was tentatively concluded that the overall effects from feral burro grazing on populations of this cactus are similar to that of livestock grazing.

8.3 Soil Analysis Data

Soil samples were taken at various locations during the course of this survey and analyzed at the Texas A&M University Soil Extension Test Lab. The overall intent of the soil analysis effort past and present has been to identify trends relative to preferred substrates for this species.

Figures 8.3-1 and 8.3-2 depict the locations where the samples were taken. Each sample has been numbered to correspond to the nurbers on these maps and the results appear on Table 8.3-1. Data accumulated from some past analyses have been included for comparison purposes.

Root mappings to date indicate that most of the roots of this species are surface roots and are usually found within the uppermost soil layer or "A" horizon (sometimes not discernable). For this reason, soil samples were only taken to a maximum depth of 10 cm..

It should be emphasized that a large number of samples must be taken to obtain a reliable average composition in any one area. Unfortunately, time and resources did not permit such an extensive survey. It would appear, however, that the following generalities can be drawn from the NWC samples taken:

- The NWC average for each constituent fell within the range of values from samples collected elsewhere.
- pH values were generally lower and organic matter content higher than in samples collected elsewhere.

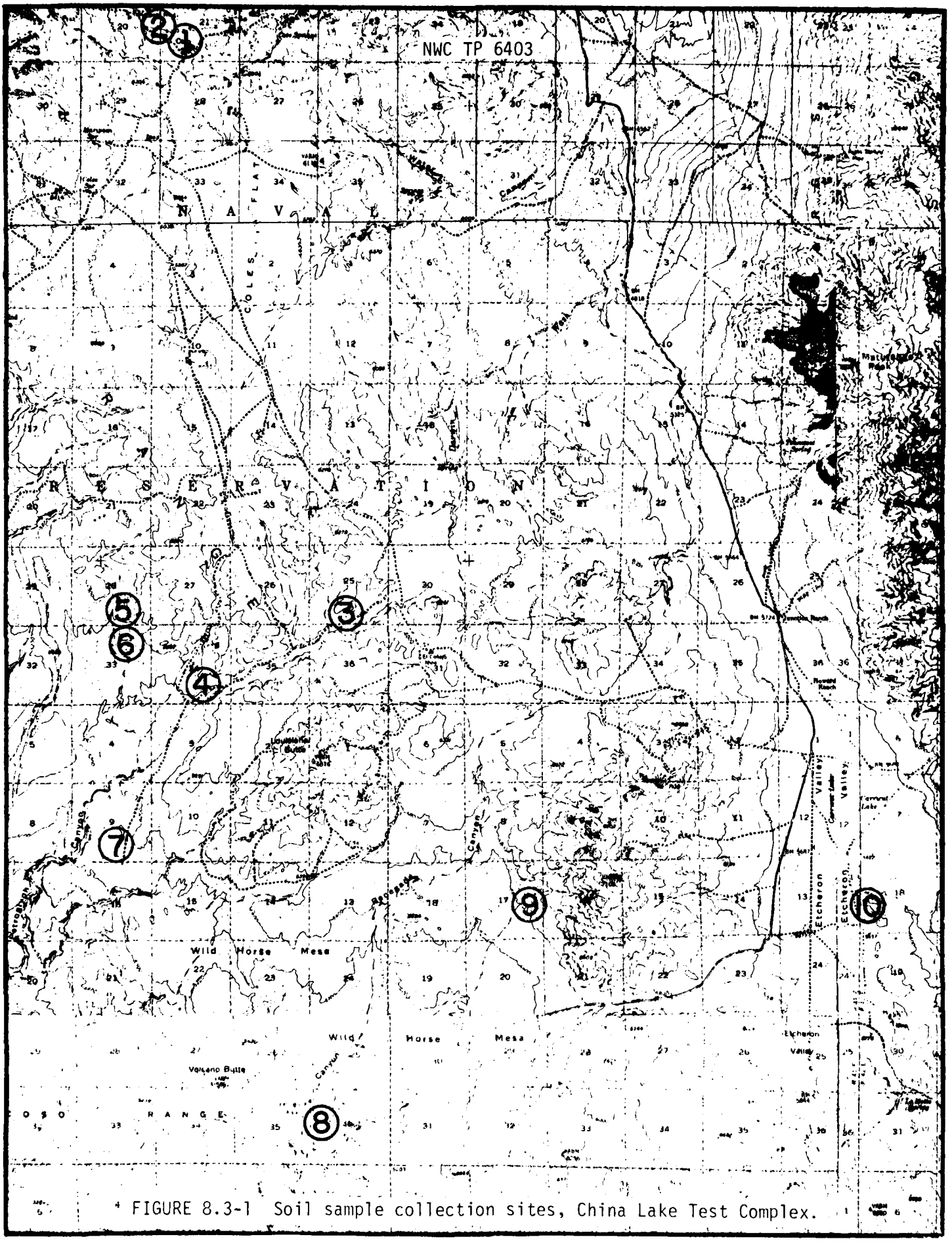


FIGURE 8.3-1 Soil sample collection sites, China Lake Test Complex.

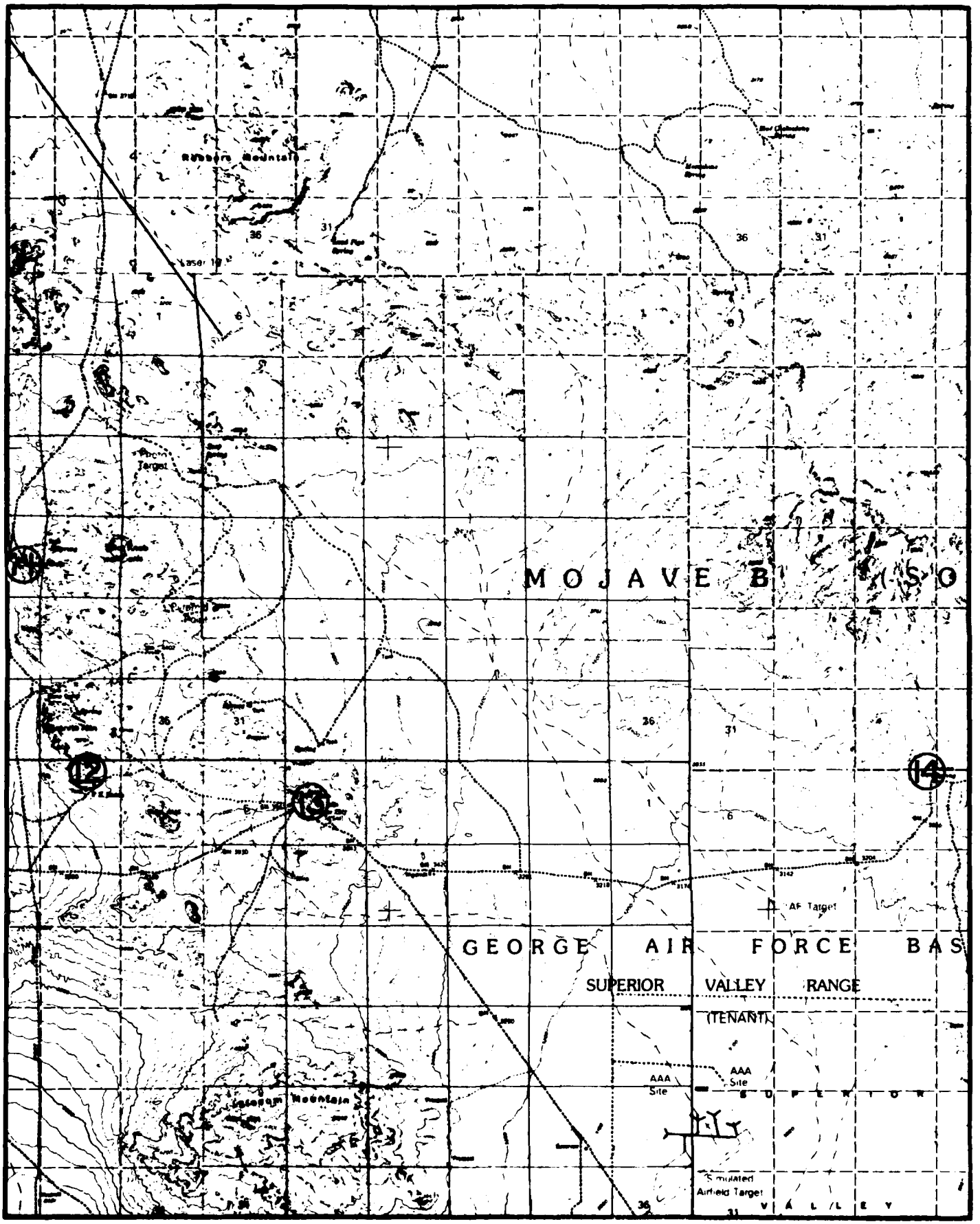


FIGURE 8.3-2 Soil sample collection sites, Mojave B Range.

TABLE 8.3-1 Results of the soil sample analysis.

	NWC SOIL SAMPLES (p.p.m.[1]) (Refer to Figures 8.3-1 & 8.3-2)															SCPO SOIL SAMPLES COLLECTED ELSEWHERE[2]		
ELEMENT/PROPERTY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	NWC AVE.	AVE.	MAX.	MIN.
Phosphorous (P)	45	35	38	150+	39	63	20	68	55	150+	150+	44	113	117	77+	142	450	31
Potassium (K)	284	276	216	800	452	804	436	648	260	308	376	524	364	620	455	373	560	220
Calcium (Ca)	1720	1720	1040	3320	1960	3040	2440	2200	1640	1960	2680	2120	2840	2240	2209	20545	106000	1160
Magnesium (Mg)	230	275	180	355	365	500+	485	390	350	195	320	340	255	500+	339+	353+	500+	117.5
Zinc (Zn)	1.48	1.20	1.46	1.74	1.48	.92	.78	.70	1.62	.94	1.66	1.00	.50	.92	1.17	.73	1.36	.36
Iron (Fe)	6.0	7.4	6.4	5.8	3.0	10.0	6.0	4.6	6.8	2.6	8.6	8.4	5.6	3.6	6.1	3.9	8.8	2.0
Manganese (Mn)	10.0	8.5	9.5	10.0	8.6	7.7	5.1	4.1	9.3	5.5	8.6	10.0	6.1	5.8	7.8	5.5+	10+	1.3
Copper (Cu)	.50	.74	.84	.72	.64	1.08	.78	1.08	.60	.64	1.94	2.00	2.00	.50	1.00	.54	1.04	.20
% Organic Matter	1.05	.80	.72	2.92	1.72	.85	.72	.68	.95	.90	2.00	1.58	.64	1.15	1.19	.60*	.90*	.48*
pH	6.9	7.4	7.8	7.5	7.4	7.3	7.2	8.1	7.2	8.0	7.2	7.2	7.4	7.6	7.4	8.3	9.0	7.3

* only 10 samples

REMARKS:

- All samples from "A" horizon (depth: 10 cm. max.)
- Samples 1 & 2 from Coso Village; sample 1 from soils lighter in color derived from granite with greater percentages of orthoclase present. Sample 2 from darker soils derived from granite with greater percentages of quartz present. Scpo found on sample 1 soils.
- Sample 6 on darker, red soil on mesa where Scpo not found.
- Samples 4, 6, 7, 8, & 11 are soils where basalts are dominant.

1 Easily extractable plant available forms, not total amount in soil.

2 Based on 13 A horizon samples collected from soils in diverse Scpo habitats.

- NWC samples were lower than average in calcium content.
- "Mesa" soils (basalt parent material) were generally higher in calcium content than NWC samples collected elsewhere.
- On the darker, red soils (sample #6, on mesa) where Scpo was not found, the iron and potassium content was higher than average.[1]
- There were no significant differences in the two samples collected at Coso Village where two apparent soil types were found (see discussion, Section 7.1).

8.4 Survey of Local Plant Communities

Partial lists of flora were compiled during the course of the survey. Figures 8.4-1 and 8.4-2 depict the locations where the inventories were taken. The numbered plant lists to follow (Tables 8.4-1 through 8.4-17) correspond to the numbered locations on these maps.

It was not always possible, particularly during the winter months, to obtain adequate specimens to ensure positive species identification. Such plants on the lists are so indicated (*). In some cases, there was not enough time to evaluate the frequency of a species in any one area. Such "occurrence" values are also noted (*). Common names were taken from several sources and may not represent the most commonly used nomenclature. Some assistance was also obtained during the identification process, most notably from Mary DeDecker. The author, however, assumes full responsibility for any errors.

1 It would appear that soil temperatures and porosity in these dark soils may be a more significant factor relative to the absence of Scpo.

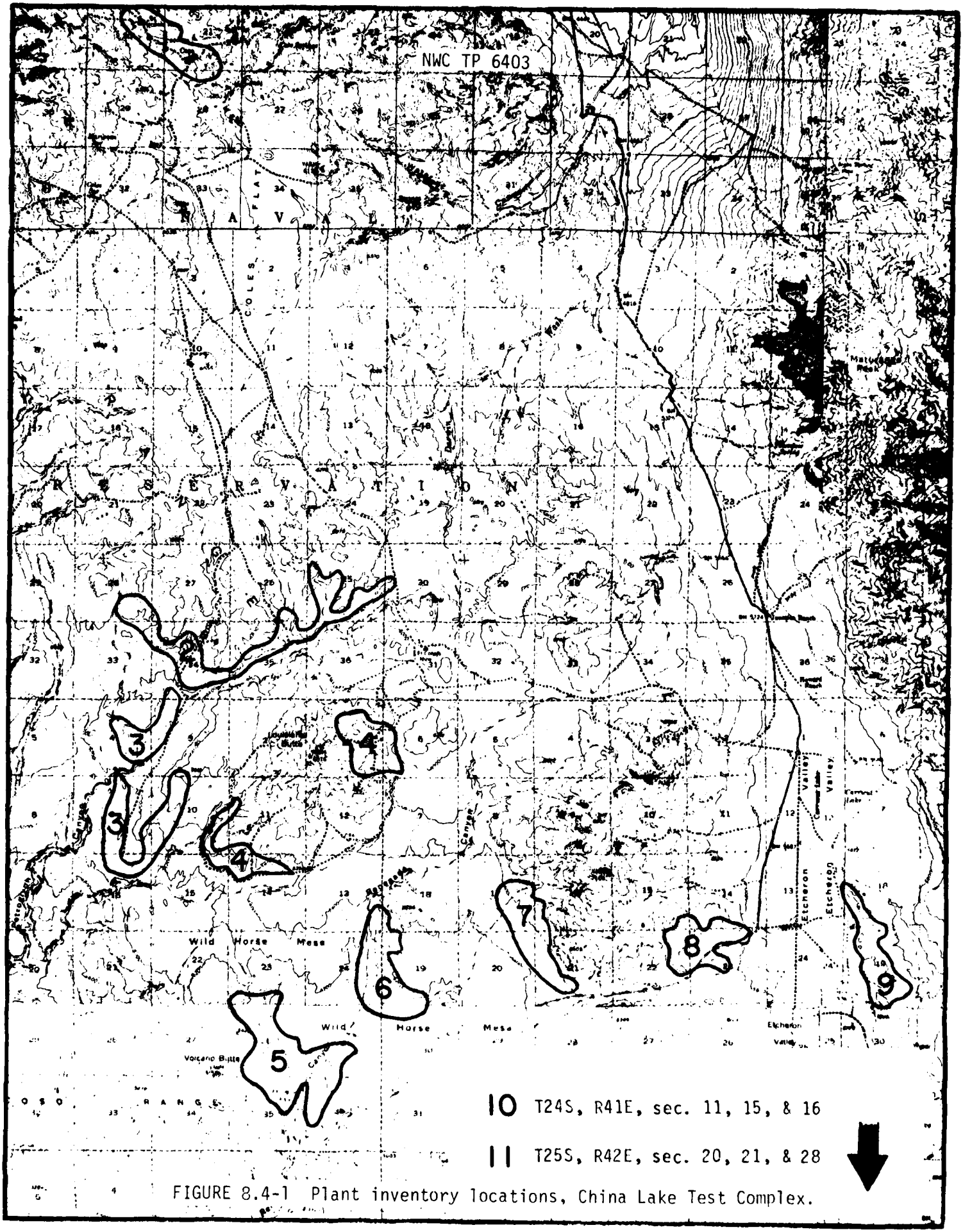


FIGURE 8.4-1 Plant inventory locations, China Lake Test Complex.

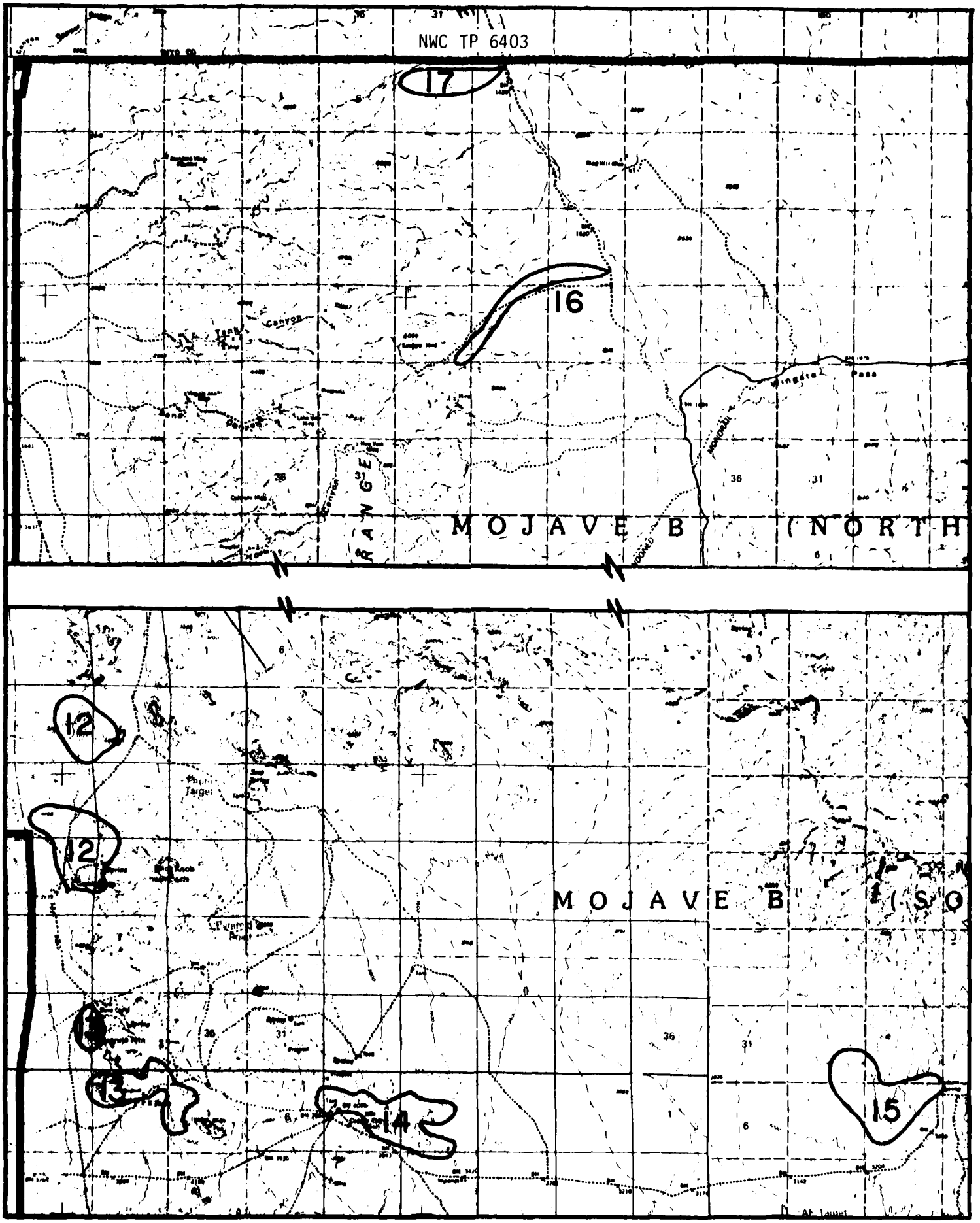


FIGURE 8.4-2 Plant inventory locations, Mojave B Range.

TABLE 8.4-1 Partial List of Flora, Location 1.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE**	REMARKS
Coleogyne	ramosissima	Blackbrush	1	
Artemisia	tridentata	Big Sagebrush	3	
Purshia	glandulosa	Waxy Bitterbrush	4	
Haplopappus	linearifolius	Linear Leaved Goldenbush	3	
Hymenoclea	salsola	Cheesebush	4	
Yucca	brevifolia	Joshua Tree	5	
Tetradymia	spinosa*	Cotton-Thorn	4	
Ephedra	nevadensis	Nevada Joint Fir	3	
Ephedra	viridis	Mountain Joint Fir	4	
Eriogonum	fasciculatum/ polifolium	Wild Buckwheat	3	
Eriogonum	Kennedyi		3	Most abundant N. of village
Bromus	rubens	Red Brome	2	
Opuntia	erinacea	Old Man Prickly Pear	4	
Opuntia	basilaris	Beavertail Cactus	4	
Opuntia	echinocarpa	Silver Cholla	5	
Sclerocactus	polyancistrus	Mojave Fishhook	5	
Echinocereus	Engelmannii	Hedgehog Cactus	5	One cluster found in canyon
Gilia	sp.		4	
Gilia	sp.		4	
Gilia	dichotoma	Evening Snow	5	
Cassia	armata	Desert Cassia	4	
Mentzelia	sp.		5	
Salvia	columbariae	Chia	3	
Layia	glandulosa	Tidy Tips	4	
Lomatium	mohavense	Desert Parsley	2	
Dichelostemma	pulchellum	Desert Hyacinth	4	
Baeria	chrysostoma*	Goldfields	3	
Eriophyllum	Wallacei	Wallace Eriophyllum	2	
Oenothera	caespitosa/ marginata	Primrose	5	South of village
Plagiobothrys	sp.	Popcorn-Flower	4	More numerous in lower canyons
Castilleja	chromosa	Indian Paintbrush	4	
Sphaeralcea	sp.	Mallow	4	Probably ambigua
Astragalus	sp.		4	White, fuzzy seed

TABLE 8.4-2 Partial List of Flora, Location 2.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE **	REMARKS
Coleogyne	ramosissima	Blackbrush	1	
Artemisia	tridentata	Big Sagebrush	1	
Haplopappus	Cooperi	Cooper Goldenbush	4	
Grayia	spinosa	Hop Sage	3	
Tetradymia	sp.		4	
Salazaria	mexicana	Paperbag Bush	5	
Yucca	brevifolia	Joshua Tree	4	
Ephedra	nevadenis	Nevada Joint Fir	3	
Ephedra	viridis	Mountain Joint Fir	4	
Lycium	Andersonii	Anderson Thornbush	4	
Purshia	glandulosa	Waxy Bitterbrush	4	
Opuhtia	echinocarpa	Silver Cholla	4	
Opuntia	erinacea	Old Man Prickly Pear	4	
Opuntia	basilaris	Beavertail Cactus	5	
Sclerocactus	polyancistrus	Mojave Fishhook	4	
Bromus	rubens	Red Brome	2	
Stipa	speciosa	Desert Needle	5	
Bromus	tectorum*	Cheat Grass	3	
Eriogonum	fasciculatum/ polifolium	Wild Buckwheat	4	
Euphorbia	albomarginata	Rattlesnake Weed	2	
Descurainia	pinnata	Tansy Mustard	5	
Phlox	Stansburyi*	Stansbury Phlox	5	
Plagiobothrys	nothofulvus*	Popcorn-Flower	4	
Astragalus	sp.		4	
Gilia	aurea	Golden Gilia	4	
Gilia	dichotoma	Evening Snow	5	
Gilia	cana*	Gilia	4	
Mentzelia	sp.		4	
Arabis	glaucovalvula*	Rock Cress	5	
Layia	glandulosa	Tidy Tips	4	
Dichelostemma	pulchellum	Desert Hyacinth	5	
Castilleja	chromosa	Indian Paintbrush	4	
Amsinckia	tessellata*	Checker Fiddleneck	4	
Lomatium	mohavense	Desert Parsley	3	
Lupine	brevicaulis*	Short-Stemmed Lupine	4	
Eriophyllum*	ambiguum*	Yellow-Frocks	4	(or Lasthenia)

TABLE 8.4-3 Partial List of Flora, Location 3.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE **	REMARKS
Atriplex	canescens	Wingscale	4	
Ephedra	nevadensis	Nevada Joint Fir	3	
Ephedra	viridis	Mountain Joint Fir	5	
Larrea	tridentata	Creosote Bush	5	Extreme south end
Haplopappus	Cooperi	Cooper Goldenbush	3	
Purshia	glandulosa	Waxy Bitterbrush	4	
Lycium	Cooperi*	Boxthorn	4	
Coleogyne	ramosissima	Blackbrush	3	
Yucca	brevifolia	Joshua Tree	4	
Tetradymia	sp.		4	
Grayia	spinosa	Hop Sage	3	
Eriogonum	trichopes	Little Trumpet	3	
Eriogonum	fasciculatum/ polifolium	Wild Buckwheat	4	
Sitanion	hystrix	Bottlebrush Squirrel-tail	4	
Bromus	rubens	Red Brome	2	
Bromus	tectorum	Cheat Grass	1	
Calochortus	Kennedyi	Desert Mariposa	4	
Lupine	horizontalis/ platypetalus	Wide-Petaled Lupine	4	
Opuntia	basilaris	Beavertail Cactus	4	
Opuntia	echinocarpa	Silver Cholla Cactus	5	
Sclerocactus	polyancistrus	Mojave Fishhook	5	
Cirsium	mohavense*	Mojave Thistle	5	(pink flower)
Cirsium	neomexicanum*	New Mexico Thistle	5	(white flower)
Euphorbia	albomarginata	Rattlesnake Weed	2	
Sphaeralcea	ambigua	Apricot Mallow	4	
Castilleja	chromosa	Indian Paintbrush	4	

TABLE 8.4-4 Partial List of Flora, Location 4

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE **	REMARKS
Coleogyne	ramosissima	Blackbrush	3	
Hymenoclea	salsola	Cheesebush	4	
Atriplex	camescens	Wingscale	3	
Haplopappus	Cooperi	Cooper Goldenbush	4	
Haplopappus	linearifolius	Linear Leaved Goldenbush	3	
Salazaria	mexicana	Paperbag Bush	5	
Lycium	Cooperi	Boxthorn	4	
Yucca	brevifolia	Joshua Tree	4	
Tetradymia	sp.		5	
Purshia	glandulosa	Waxy Bitterbrush	4	
Ephedra	nevadenis	Nevada Joint Fir	3	
Ephedra	viridis	Mountian Joint Fir	4	
Encelia	virginensis	Acton Encelia	4	
Opuntia	basilaris	Beavertail Cactus	4	
Sclerocactus	polyancistus	Mojave Fishhook	4	
Bromus	rubens	Red Brome	1	
Stipa	speciosa	Desert Needle	3	
Eriogonum	sp.		4	
Eriogonum	nudum	Long Trumpet	4	
Anisocoma	acaulis	Scalebud	2	
Mirabilis	Froebelii	Giant 4 O'clock	2	
Oxytheca	perfoliata	Saucer Plant	3	
Lasthenia	sp.		3	
Camissonia	sp.		3	
Delphinum	Parishii	Desert Larkspur	5	
Penstemon	sp.		2	(probably incertus)
Sphaeralcea	ambigua	Apricot Mallow	4	
Dichelostemma	pulchellum	Desert Hyacinth	5	
Phacelia	tanacetifolia	Tansy Phacelia	3	
Langloisia	Matthewsii*	Desert Calico	5	
Castilleja	chromosa	Indian Paintbrush	4	
Stanleya	pinnata	Prince's Plume	4	
Calochortus	Kennedyi	Desert Mariposa	4	
Lomatium	mohavense	Desert Parsley	4	
Eriophyllum	Wallacei	Wallace Eriophyllum	3	
Lupine	sp.		4	
Gilia	sp.		4	
Pectocarya	setosa*	Pectocarya	3	
Cryptantha	sp.		3	
Eriastrum	sp.		3	

TABLE 8.4-5 Partial List of Flora, Location 5.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE**	REMARKS
Atriplex	canescens*	Wingscale	*	Poor speciman
Larrea	tridentata	Creosote Bush	5	at southern end
Hymenoclea	salsola	Cheesebush	4	
Coleogyne	ramosissima	Blackbrush	4	
Dalea	Fremontii	Fremont Dalea	4	
Gutierrezia	microcephala	Sticky Snakeweed	4	
Lycium	Andersonii	Anderson Thornbush	3	
Grayia	spinosa	Hop Sage	4	
Encelia	virginensis	Acton Encelia	5	
Haplopappus	Cooperi	Cooper Goldenbush	3	
Haplopappus	linearifolius	Linear Leaved Goldenbush	3	
Lycium	Cooperi	Boxthorn	4	
Ephedra	nevadensis	Nevada Joint Fir	4	
Eurotia	lanata	Winter Fat	5	
Sphaeralcea	ambigia	Apricot Mallow	4	
Lomatium	mohavense	Desert Parsley	*	
Eriogonum	trichopes	Little Trumpet	4	
Eriogonum	fasciculatum/ polifolium	Wild Buckwheat	3	
Stephanomeria	exigua	Annual Mitra	4	
Bromus	tectorum	Cheat Grass	1	
Stipa	speciosa	Desert Needle	4	
Bromus	rubens	Red Brome	1	
Hilaria	Jamesii	Galleta Grass	4	
Lepidium	sp.		5	East of wash
Dichelostemma	pulchellum	Desert Hyacinth	5	
Machaeranthera	tortifolia	Mojave Aster	5	
Sclerocactus	polyancistrus	Mojave Fishhook	5	
Opuntia	basilaris	Beavertail Cactus	4	
Opuntia	echinocarpa	Silver Cholla	4	
Cirsium	mohavense	Mojave Thistle	5	
Eriogonum	inflatum	Desert Trumpet	4	
Castilleja	chromosa	Indian Paintbrush	4	
Calochortus	Kennedyi	Desert Mariposa	4	
Euphorbia	albomarginta	Rattlesnake Weed	4	
Eriastrum	sapphirinum/ssp. ambiguum	Mojave Eriastrum	3	
Chaenactis	sp.		4	

TABLE 8.4-6 Partial List of Flora, Location 6.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE**	REMARKS
Coleogyne	ramosissima	Blackbrush	1	
Hymenoclea	salsola	Cheesebush	3	
Lycium	Cooperi*	Boxthorn	4	
Purshia	glandulosa	Waxy Bitterbrush	5	In washes only
Salazaria	mexicana	Paperbag Bush	4	
Haplopappus	Cooperi	Cooper Goldenbush	4	
Eriogonum	sp.		3	
Ephedra	nevadensis	Nevada Joint Fir	3	
Ephedra	viridis	Mountain Joint Fir	5	
Grayia	spinosa	Hop Sage	4	
Yucca	brevifolia	Joshua Tree	4	
Opuntia	echinocarpa	Silver Cholla	4	
Opuntia	basilaris	Beavertail Cactus	4	
Bromus	rubens	Red Brome	2	
Oryzopsis	hymenoides	Indian Ricegrass	4	
Lomatium	mohavense	Desert Parsley	4	
Gilia	sp.		*	
Encelia	virginensis	Acton Encelia	4	
Oxytheca	perfoliata	Saucer Plant	4	
Eriastrum	sp.		3	
Dichelostemma	pulchellum	Desert Hyacinth	4	
Penstemon	incertus	Western Desert Penstemon	3	
Astragalus	sp.		4	
Amsinckia	tessellata*	Checker Fiddleneck	4	
Castilleja	chromosa	Indian Paintbrush	4	
Salvia	colombariae	Chia	4	
Arabis	pulchra/munciensis	Rock-Cress	4	
Erigeron	Breweri/ porphyreticus	Boulder Daisy	3	
Camissonia	Boothii/ssp. desertorum*	Bottle Cleaner	4	(Oenothera decorticans)
Cuscuta	denticulata	Dodder	5	

TABLE 8.4-7 Partial List of Flora, Location 7.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE **	REMARKS
Coleogyne	ramosissima	Blackbrush	1	
Salazaria	mexicana	Paperbag Bush	4	
Haplopappus	Cooperi	Cooper Goldenbush	3	
Haplopappus	linearifolius	Linear Leaved Goldenbush	3	
Purshia	glandulosa	Waxy Bitterbrush	2	
Yucca	brevifolia	Joshua Tree	4	
Ephedra	nevadensis	Nevada Joint Fir	3	
Ephedra	viridis	Mountain Joint Fir	3	
Sclerocactus	polyancistrus	Mojave Fishhook	5	
Opuntia	basilaris	Beavertail Cactus	4	
Bromus	rubens	Red Brome	1	
Castilleja	chromosa	Indian Paintbrush	5	
Gilia	sp.		3	
Calochortus	Kennedyi	Desert Mariposa	4	

TABLE 8.4-8 Partial List of Flora, Location 8.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE **	REMARKS
Coleogyne	ramosissima	Blackbrush	1	
Artemisia	tridentata	Big Sagebrush	2	In "flats"
Haplopappus	Cooperi*	Cooper Goldenbush	3	Could have been linearifolius
Ephedra	nevadensis	Nevada Joint Fir	3	
Ephedra	viridis	Mountain Joint Fir	4	
Yucca	brevifolia	Joshua Tree	4	
Echinocereus	Engelmannii	Hedgehog Cactus	4	
Opuntia	basilaris	Beavertail Cactus	5	
Opuntia	echinocarpa	Silver Cholla	4	
Sclerocactus	polyancistrus	Mojave Fishhook	4	
Bromus	rubens	Red Brome	2	
Stipa	speciosa	Desert Needle	4	
Lomatium	mohavense	Desert Parsley	3	
Coreopsis	Bigelovii	Bigelow Coreopsis	5	
Salvia	colombariae	Chia	4	
Dichelostemma	pulchellum	Desert Hyacinth	4	
Phacelia	sp.		4	
Lupine	sp.		4	
Sphaeralcea	ambigua	Apricot Mallow	4	
Castilleja	chromosa	Indian Paintbrush	4	

TABLE 8.4-9 Partial List of Flora, Location 9.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE **	REMARKS
Coleogyne	ramosissima	Blackbrush	1	
Grayia	spinosa	Hop Sage	1	
Artemisia	tridentata	Big Sagebrush	1	Mostly in flats.
Chrysothamnus	teretifolius	Rabbitbush	3	
Yucca	brevifolia	Joshua Tree	4	
Ephedra	nevadensis	Nevada Joint Fir	3	
Ephedra	viridis	Mountain Joint Fir	4	
Eriogonum	fasciculatum/ polifolium	Wild Buckwheat	3	
Haplopappus	Cooperi	Cooper Goldenbush	*	
Echinocereus	Engelmannii	Hedgehog Cactus	5	Two carcasses only.
Opuntia	basilaris	Beavertail Cactus	5	
Opuntia	echinocarpa	Silver Cholla	4	
Sclerocactus	polyancistrus	Mojave Fishhook Cactus	4	
Astragalus	purshii*/tinctus	Pursh Locoweed	4	No seed available.
Lomatium	mohavense	Desert Parsley	4	
Arabis	pulchra/gracilis	Rock Cress	4	
Tridens*	pulchellus*	Fluffgrass	3	
Amsinckia	tessellata	Checker Fiddleneck	2	

TABLE 8.4-10 Partial List of Flora, Location 10.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE**	REMARKS
Larrea	tridentata	Creosote Bush	1	
Hymenoclea	salsola	Cheesebush	3	
Salazaria	mexicana	Paperbag Bush	5	
Tetradymia	stenolepsis*	Felt-Thorn	4	No leaves
Atriplex	polycarpa	Allscale	4	
Lycium	Andersonii*	Anderson Thornbush	*	No leaves
Chrysothamnus	teretifolius	Rabbit Bush	3	
Haplopappus	Cooperi	Cooper Goldenbush	3	
Ephedra	nevadensis	Nevada Joint Fir	3	
Eriogonum	fasciculatum	Wild Buckwheat	4	
Eriogonum	inflatum	Desert Trumpet	2	
Opuntia	basilaris	Beavertail Cactus	4	
Echinocactus	polycephalus	Cotton-Top Cactus	4	
Stipa	speciosa	Desert Needle	5	
Schismus	arabicus		3	
Mirabilis	Bigelovii*	Wishbone Bush	4	

TABLE 8.4-11 Partial List of Flora, Location 11.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE **	REMARKS
Larrea	tridentata	Creosote Bush	1	
Hymenoclea	salsola	Cheesebush	3	
Ambrosia	dumosa	Burrobush	1	
Ephedra	nevadensis	Nevada Joint Fir	3	
Eriogonum	fasciculatum	Wild Buckwheat	3	
Eriogonum	inflatum	Desert Trumpet	3	
Lycium	Andersonii*	Anderson Thornbush	3	No leaves
Acamptopappus	sphaerocephalus	Goldenhead	4	
Echinocactus	polycephalus	Cotton-Top Cactus	4	High occurance in hills to the east
Opuntia	basilaris	Beavertail Cactus	4	
Schismus	aribicus		2	
Oryzopsis	sp.		3	
Astragalus	sp.		4	Probably lentiginosus
Abronia	villosa	Hairy Sand-Verbena	4	
Sphaeralcea	ambigua	Desert Mallow	5	
Cuscuta	denticulata	Dodder	4	

PARTIAL LIST OF FLORA

TABLE 8.4-12 Partial List of Flora, Location 12.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE **	REMARKS
Larrea	tridentata	Cresote Bush	2	
Grayia	spinosa	Hop Sage	2	
Hymenoclea	salsola	Cheesebush	4	
Lycium	Andersonii*	Anderson Thornbush	3	No leaves
Lycium	sp.		5	No leaves (probably Cooperi)
Yucca	brevifolia	Joshua Tree	4	
Ambrosia	dumosa	Burrobush	4	
Haplopappus	Cooperi	Cooper Goldenbush	4	
Chrysothamnus	teretifolius	Green Rabbitbush	2	
Encelia	virginensis	Acton Encelia	4	
Ephedra	nevadensis	Nevada Joint Fir	3	
Coleogyne	ramosissima	Blackbrush	4	
Eriogonum	fasciculatum	Wild Buckwheat	4	
Eriogonum	inflatum	Desert Trumpet	5	
Echinocactus	polycephalus	Cotton-Top Cactus	5	
Sclerocactus	polyancistrus	Mojave Fishhook	4	
Opuntia	echinocarpa	Silver Cholla	4	
Opuntia	basilaris	Beavertail Cactus	5	
Schismus	arabicus		3	
Stipa	speciosa	Desert Needle	4	
Bromus	rubens	Red Brome	4	
Erodium	texanum	Heron's Bill	2	
Plantago	insularis*/ fastigiata	Woolly Plantain	2	
Sphaeralcea	ambigua	Apricot Mallow	5	
Lupine	sp.		4	Blooms violet
Coreopsis	Bigelovii	Begelow Coreopsis	3	
Syntrichopappus	Fremontii	Fremont Xerasid	4	
Salvia	columbariae	Chia	4	North of well
Phacelia	crenulata*	Heliotrope Phacelia	3	North of well
Gilia	cana/triceps	Gilia	4	North of well
Amphipappus*	Fremontii	Eytelia	5	No leaves
Amsinckia	tessellata*	Checker Fiddleneck	3	

TABLE 8.4-13 Partial List of Flora, Location 13.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE **	REMARKS
Larrea	tridentata	Creosote Bush	1	
Grayia	spinosa	Hop Sage	1	
Hymenoclea	salsola	Cheesebush	3	
Lycium	Andersonii*	Anderson Thornbush	4	No leaves
Yucca	brevifolia	Joshua Tree	4	
Tetradymia	sp.		4	
Chrysothamnus	teretifolius	Terete-Leaved Rabbit-bush	4	Occurrence greater south of P.K. Ranch
Haplopappus	Cooperi	Cooper Goldenbush	2	
Encelia	virginensis	Acton Encelia	4	
Ephedra	nevadensis	Nevada Joint Fir	3	
Eriogonum	inflatum	Desert Trumpet	2	
Eriogonum	fasciculatum	Wild Buckwheat	4	
Sclerocactus	polyancistrus	Mojave Fishhook	4	
Opuntia	echinocarpa	Silver Cholla	4	
Echinocactus	polycephalus	Cotton-Top Cactus	4	
Schismus	arbicus		4	South of road
Bromus	rubens	Red Brome		
Stipa	speciosa	Desert Needle	4	
Erodium	texanum	Heron Bill	3	
Sphaeralcea	ambigua	Apricot Mallow	5	
Amsinckia	tessellata	Checker Fiddleneck	3	

TABLE 8.4-14 Partial List of Flora, Location 14.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE **	REMARKS
Larrea	tridentata	Creosote Bush	1	
Grayia	spinosa	Hop Sage	4	
Hymenoclea	salsola	Cheesebush	4	
Lycium	Andersonii	Anderson Thornbush	3	No leaves
Eurotia	lanata	Winter Fat	5	
Ambrosia	dumosa	Burrobush	4	In flats north of well
Tetradymia	stenolepis	Felt Thorn	4	east of well
Haplopappus	Cooperi	Cooper Goldenbush	3	
Chrysothamnus	teretifolius	Rabbitbush	4	
Encelia	virginensis	Acton Encelia	4	
Ephedra	nevadensis	Nevada Joint Fir	4	
Eriogonum	inflatum	Desert Trumpet	2	
Eriogonum	fasciculatum	Wild Buckwheat	3	
Opuntia	basilaris	Beavertail Cactus	5	
Sclerocactus	polyancistrus	Mojave Fishhook	5	
Opuntia	echinocarpa	Silver Cholla	5	
Stipa	speciosa	Desert Needle	3	
Bromus	rubens	Red Brome	2	
Amphipappus	Fremontii	Eytelia	4	
Salvia	columbariae	Chia	5	
Camissonia	sp.		5	
Sphaeralcea	ambigua	Apricot Mallow	5	
Amsinckia	tessellata	Checker Fiddleneck	4	
Erodium	texanum	Heron Bill	3	
Machaeranthera	tortifolia	Mojave Aster	5	

TABLE 8.4-15 Partial List of Flora, Location 15.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE**	REMARKS
Larrea	tridentata	Creosote Bush	2	
Hymenoclea	salsola	Cheesebush	3	
Ambrosia	dumosa	Burrobush	4	
Atriplex	polycarpa*	Allscale	4	
Stephanomeria	sp.		5	
Ephedra	nevadensis	Nevada Joint Fir	4	
Lycium	Cooperi*	Boxthorn	4	
Lycium	Andersonii	Anderson Thornbush	3	
Haplopappus	Cooperi	Cooper Goldenbush	4	
Haplopappus	linearifolius	Linear Leaved Goldenbush	4	
Eurotia	lanata	Winter Fat	5	
Salazaria	mexicana	Paperbag Bush	4	
Encelia	virginensis	Acton Encelia	4	
Eriogonum	fasciculatum	Wild Buckwheat	4	
Eriogonum	inflatum	Desert Trumpet	3	
Opuntia	echinocarpa	Silver Cholla	4	
Sclerocactus	polyancistrus	Mojave Fishhook	5	
Echinocactus	polycephalus	Cotton-Top Cactus	4	
Bromus	tectorum	Cheat Grass	4	
Bromus	rubens	Red Brome	2	
Schismus	barbatus		3	
Stipa	speciosa	Desert Needle	4	
Sphaeralcea	ambigua	Apricot Mallow	4	
Delphinium*	sp.	Larkspur	4	Poor condition
Chorizanthe	brevicornu	Brittle Chorizanthe	4	
Machaeranthera	tortifolia	Mojave Aster	4	
Amsinckia	tessellata*	Checker Fiddleneck	4	
Dichelostemma	pulchellum	Desert Hyacinth	5	
Mirabilis	Bigelovii*	Wishbone Bush	4	

TABLE 8.4-16 Partial List of Flora, Location 16.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE**	REMARKS
Larrea	tridentata	Creosote Bush	1	
Eriogonum	inflatum	Desert Trumpet	3	
Amphipappus	Fremontii	Eytelia	4	
Plantago	insularis/ fastigiata	Wooly Plantain	3	
Oenothera	dentata	Tooth-Leaved Primrose	4	(Camissonia campestris)
Eschscholzia	glyptosperma	Poppy	5	
Mendora	spinescens	Twin Fruit	4	
Lupine	sp.		4	
Erodium	texanum	Heron Bill	3	
Echinocactus	polychephalus	Cotton-Top Cactus	5	Higher elevations
Phacelia	sp.		*	
Monoptilon	bellidiforme	Mojave Desert Star	*	
Dichelostemma	pulchellum	Desert Hyacinth	5	
Rafinesquia	neomexicana	Desert Chicory	5	

TABLE 8.4-17 Partial List of Flora, Location 17.

** Occurrence: 1=Very Frequent, 2=Frequent, 3=Average, 4=Occasional, 5=Rare
* Identification/occurrence uncertain

GENUS	SPECIES/VAR.	COMMON NAME	OCCURRENCE **	REMARKS
Larrea	tridentata	Creosote Bush	1	
Ambrosia	dumosa	Burrobush	1	
Hymenoclea	salsola	Cheesebush	4	
Encelia	virginensis	Acton Encelia	3	
Eriogonum	fasciculatum/ polifolium	Wild Buckwheat	4	
Eriogonum	inflatum	Desert Trumpet	1	
Opuntia	basilaris	Beavertail Cactus	4	
Mammillaria	tetrancistra	Corkseed Cactus	5	
Echinocactus	polycephalus	Cottontop Cactus	5	
Oenothera	denata	Tooth-leaved Primrose	4	(Camissonia campestris)
Salvia	columbariae	Chia	4	
Plantago	insularis/ fastigiata	Woolly Plantain	3	
Coreopsis	Bigelovii	Bigelow Coreopsis	4	Higher elevations
Gilia	cana/speciformis	Gilia	4	
Coreopsis	sp.		4	White flower
Amsinckia	tessellata	Checker Fiddleneck	5	

9.0 NWC REFUGE POTENTIAL

Although Sclerocactus polyancistrus has a widespread distribution and, in some cases, occurs in remote regions, population densities are normally quite low. It has been stated in a recent survey by Rhoads (et al, 1979): "This species is not as rare as some proposed for Federal Listing, but few of the others are so immediately threatened by over-collection." Most populations of this cactus exist on public lands and are vulnerable to over-collection. Furthermore, lands which, technically, are not open to public use (railroad lands, federally managed park lands, etc.) are unfenced and still vulnerable. Current programs to designate public lands for specific uses are a step in the right direction but still have inadequacies: sensitive plants will still be removed from parks and preserves, O.R.V.s will infringe on private and ecologically sensitive lands, and sheep will occasionally graze beyond designated ranges or grazing allotments. In addition, one cannot predict with certainty future trends; land ownership and, consequently, land utilization and management practices are subject to change. Permanent refuges free from outside disturbances are desperately needed for endangered and threatened species in the Mojave Desert.

Based on the known Scpo population locations and densities and corresponding protection/management potential, there presently appear to be three refuge candidates for this species: the eastern portion of the Inyo National Forest, the Nevada/Tonopah Test Ranges in Nevada, and the China Lake Naval Weapons Center. The comparison of all three candidates appears on Table 9-1.[1]

In January 1982, the author submitted a preliminary status report on this species to the U.S. Fish and Wildlife Service in Sacramento, California. Within the report, the eastern portion of the Inyo National Forest was proposed as a possible critical habitat candidate. It would now appear, based on the results of this survey, that the China Lake NWC would be a better choice for

1 The Nevada/Tonopah Test ranges have not been surveyed by the author. Table 9-1 data relative to this region is based on the survey by Rhoads (et al, 1978, 1979).

TABLE 9-1 Comparison of refuge candidates for Sclerocactus polyancistrus.

CANDIDATE	RELATIVE SCPO DENSITY/ OCCURRENCE	PROTECTABILITY/ MANAGEMENT POTENTIAL	MISCELLANEOUS ADVANTAGES	POTENTIAL THREATS
NWC	High	Excellent (Restricted Access)	Diverse Settings For Scpo - Soils - Elevation - Predation/ Infestation	Feral Burro Grazing Burro grazing has impacted two populations.
Inyo National Forest (Eastern Region)	High	Good	-	Over-Collection Unrestricted access by public can still impose a future threat.
Nevada/Tonopah Test Ranges	Probably High	Excellent (Restricted Access)	-	Irradiation Has destroyed shrubs and increased the frequency of grass fires

the following reasons:

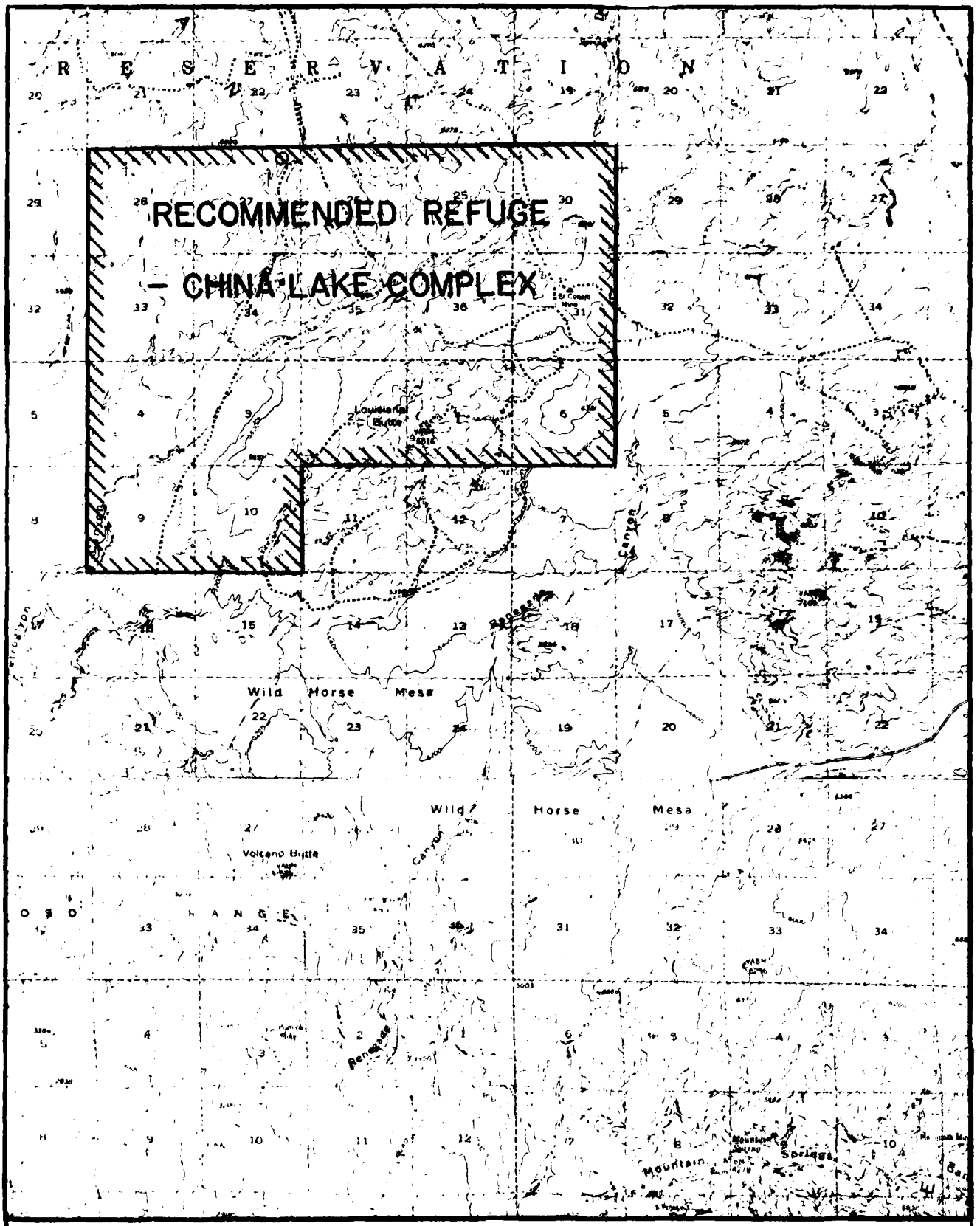
- When the Mojave B South Range is included, both ecological settings relative to infestation and small mammal predation are represented.
- Naval security will afford better protection and restrict public access, thereby eliminating the threat of over-collection within the refuge boundaries.

Figures 9-1 and 9-2 depict the areas within the NWC most suitable as a refuge for S. polyancistrus. Other sensitive plant species within these areas are also noted.

The NWC has been virtually isolated from public use since its conception in 1943. As a result, the lands within its boundaries have been, for the most part, immune to recent trends toward increased land development, recreational vehicle use, etc.. The large expanse of relatively pristine desert lands represents a field laboratory of extraordinary value which can be utilized for the study of local species of flora and fauna. At least 30 sensitive species of plants and 24 species of wildlife are known to occur on or in the vicinity of the NWC (PBR, 1981). The impact of Naval operations on the range lands has been minimal[1] and attributable in part to an effective land management and resources program. The successful implementation of the recent burro removal program is an example of the magnitude of programs within the NWC Environmental Branch capability and of its continuing efforts to preserve the NWC lands in their natural state. Security measures on the NWC ranges include fenced access routes, vehicle barriers along accessible boundaries, and continuous range patrols. Public access is carefully monitored. Security as such would provide a refuge free from outside disturbances so vital for the accomplishment of long-term ecological studies.

It is the hope of the author that the NWC lands remain under full jurisdiction of the Navy, and refuges for sensitive species of flora and fauna within the range be permanently established.

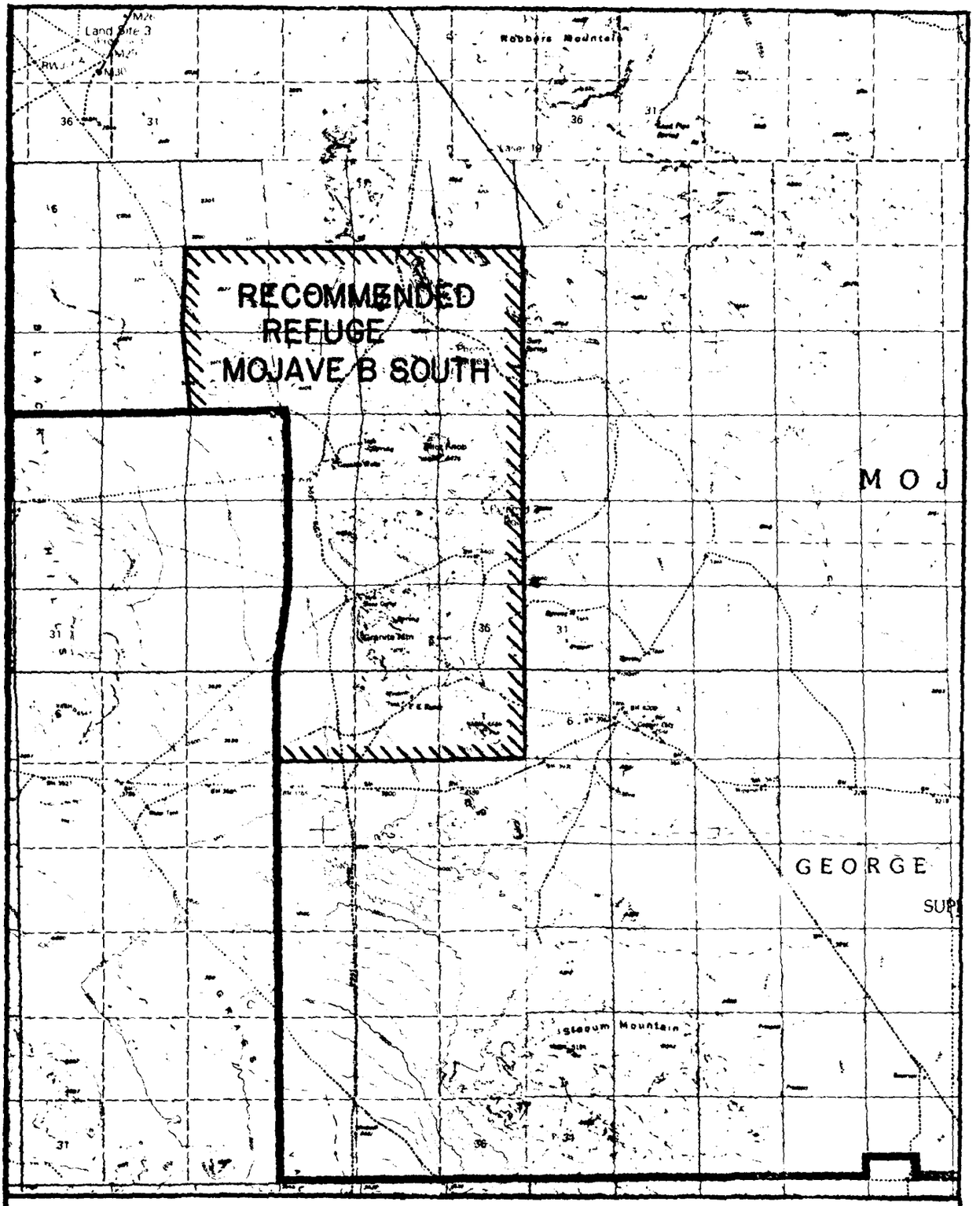
1 Much of the activity involves overflight operations and does not impact the land.



OTHER SENSITIVE PLANT SPECIES WITHIN RECOMMENDED REFUGE BOUNDARIES:

(None identified to date)

FIGURE 9.1 Recommended Scpo refuge location, China Lake Test Complex.



OTHER SENSITIVE PLANT SPECIES WITHIN RECOMMENDED REFUGE BOUNDARIES (PBR, 1981)

Phacelia mustellina
Dudleya saxosa ssp. saxosa
Dalea arborescens var. arborescens

FIGURE 9.2 Recommended Scpo refuge location, Mojave B Range.

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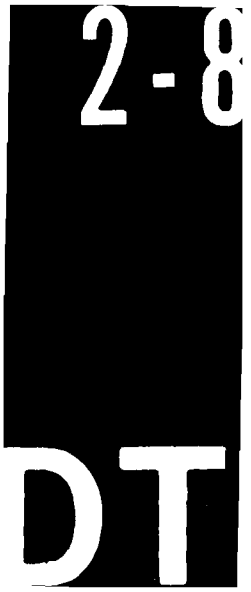
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